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ABSTRACT

This packet contains 12 teacher lesson plans with related student information sheets, job sheets, and task sheets for a course in auto body repair. Lesson plans, which are either informational or manipulative in format, take the teacher step-by-step through each lesson. Lesson information includes the subject of the lesson, aim, teaching aids, materials needed, references, prerequisite experience of the learner, motivation, presentation of the information (with instructional points in the left column and related student and teacher activities in the right column), summary, evaluation, and suggested reading for the student. Student job and task sheets break down the students' duties into steps and note the types of equipment and other material needed. Information sheets are provided. (KC)

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AUTO BODY
BLOCK VII

AB-VII

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INSTRUCTOR'S PLAN VII-A-1(I)
INFORMATIONAL LESSON

SUBJECT: Preparations for Painting

AIM: The student will be able to identify the various products and procedures used in automobile refinishing.

TEACHING AIDS: Transparencies, Figs. 1 - 8, display of products

MATERIALS:

REFERENCES: Automotive Refinishing Principles and Techniques, DuPont, Chs. 1-3, 5-10
Auto Body Repairing and Repainting, pp. 171-172

PREREQUISITE EXPERIENCE OF THE LEARNER: The student must have studied information sheet VII-A-1(IS)

I. PREPARATION (OF THE LEARNER - MOTIVATION)

The quality of an automobile finish depends entirely upon the vehicle being properly prepared for painting. The finish may be correctly applied and beautiful to behold, but unless careful preparations were made beforehand, and the correct materials used, it will soon begin to deteriorate and peel off.

II. PRESENTATION (OF THE INFORMATION)

INSTRUCTIONAL TOPICS TEACHING POINTS	THINGS FOR STUDENTS TO DO THINGS FOR INSTRUCTOR TO DO OR SAY
1. Materials or Products A. Undercoats Show Transparency: Fig. 1	1. Primer a. Prevents rust and corrosion of bare metal b. Promotes adhesion of topcoat to bare metal c. May be lacquer or enamel material d. Special primers are available for different types of metals e. Usually colored gray, yellow, or red oxide f. Applied in thin coats g. Does not require sanding before applying topcoat
Show Transparency: Fig. 2	2. Primer - Surfacer a. Promotes adhesion of topcoat b. Prevents rust and corrosion of bare

metal
c. Brings bare metal areas up to the level of the painted surface
d. Fills in scratches, nicks, and small imperfections in the surface
e. Provides smooth base for the topcoat
f. Applied in thick coats
g. May be lacquer or enamel
h. Usually colored gray or red oxide
i. Requires sanding before applying topcoat

3. Sealer
a. Promotes adhesion between old finish and new topcoat
b. Prevents sand scratches from showing up in the new paint film
c. Prevents new topcoat from soaking into the old finish
d. May be used under lacquer or enamel paints
e. Applied in a single, medium - wet coat
f. May be gray, red oxide or clear
g. Does not require sanding before applying topcoat

B. Topcoats
Show Transparency:
Fig. 3

1. Available in many colors or clear
2. May be one of several types of paint
a. Acrylic lacquer
(1) Applied in numerous coats
(2) Easy to apply
(3) Provides a hard, durable finish
(4) Must be compounded
b. Acrylic enamel
(1) Applied in one to three coats
(2) Dries to a smooth glossy finish
(3) Fast drying
(4) Needs no compounding
c. Alkyd enamel
(1) Easy to apply
(2) Applied in one to three coats
(3) Needs no compounding
(4) Long - lasting finish
d. Polyurethane enamel
(1) Contains a urethane plastic liquid agent as binder

(2) Must be mixed with a catalyst or activator before used
(3) Extremely tough and durable
(4) Requires no compounding

3. Contain three ingredients
   a. Pigment
      (1) Determines color
      (2) Hides everything underneath
   b. Binder
      (1) Holds pigment in suspension
      (2) Turns pigment into a liquid
      (3) Binds pigment to undercoat
   c. Solvent
      (1) Lacquer thinner or enamel reducer
      (2) Makes the solution thin enough to apply
      (3) Evaporates completely after application

C. Sandpaper

Show Transparency: Fig. 4

1. Cutting side known as grit side
2. Available in various grit sizes for different sanding tasks
3. May be used by hand or with power sanders
4. May be used dry or with water
5. Available in sheets or pre-cut

D. Masking Materials

Show Transparencies: Figs. 5 - 6

1. Masking tape
   a. Available in different widths for different masking tasks
   b. May be trimmed with knife or razor blade
   c. Attaches masking paper
   d. May be used by hand or pre-applied to masking paper in dispenser
2. Masking liquid
   a. May be used in place of masking paper
   b. Applied with brush
   c. Not used frequently
3. Masking paper
   a. Comes in rolls of various widths
   b. Used to cover large areas
   c. Attached with masking tape
   d. Is solvent proof

E. Solvents

1. Used to thin paint or undercoats to spraying consistency
2. Lacquer thinner or enamel reducer

3. Used to clean painting equipment
4. Special solvents for cleaning surface of vehicle
   Caution: Most solvents are very flammable and should be used with care

F. Accessory Products

1. Strainers
   a. Removes solids from liquid mixtures
   b. Prevents clogging of spraying equipment
   c. Usually made of paper and are disposable
2. Paddles
   a. Usually small thin pieces of wood
   b. Used to stir solution when mixing paint or undercoats
   c. May be reused or thrown away
3. Compounds
   a. Abrasive paste material used to clean and polish
   b. Available in several degrees of coarseness
   c. May be used by hand or with power buffers
   d. May be thinned with water if necessary

2. Procedures

1. Cleaning
   a. Prepares surface for sanding
   b. Use soap and water for dirt and grime
   c. Use special solvents for wax, road tar, and other surface contaminants
   d. Use blow gun for loose particles and dust
   e. Important step in the refinishing procedure
2. Sanding
   a. Most important step in any painting or priming operation
   b. May be done by hand or with power equipment
   c. Promotes adhesion of undercoats or topcoats
   d. Smoothes surface
   e. May be done with or without water
3. Masking
   a. Prevents overspray
   b. Accomplished by using tape, tape and

Show Transparency:
Fig. 7

paper, or masking liquid
c. Press tape down firmly
d. Must be done carefully
e. Protect glass, chrome, and unpainted areas
f. Use drop cloths or wheel covers

Show Transparency: Fig. 8

4. Mixing
a. Mix according to label recommendations
b. Use correct solvent for product being mixed
c. Use only quality products
d. Mix thoroughly
e. Use approved paddles for stirring
f. Avoid spilling solvents

5. Application
a. Undercoats
(1) Area should be dusted with blow gun
(2) Apply medium - wet coats
(3) First coat should not extend beyond featheredge
(4) Additional coats should extend slightly beyond previous coat
(5) Allow each coat to flash or turn dull before applying next coat
(6) Apply only as much material as needed

b. Topcoats
(1) Choose correct material for task
(2) Strain into paint gun cup
(3) Use recommended air pressure
(4) Use correct spraying technique for material being sprayed

Caution: Use an approved respirator mask and spray in a well ventilated area, such as the paint booth

(6) Apply only as much material as needed

6. Cleanup
a. Painting equipment
(1) Return unused material to original container and cap tightly

Note: Polyurethane products, or any other that has been mixed with a catalyst or

hardener, should be thrown away
(2) Clean paint gun thoroughly with the correct cleaning solvent
(3) Use blow gun to clean out small orifices in paint gun
(4) Clean equipment immediately after use
(5) Return equipment to storage area

b. Painting area
(1) Return all unused materials to storage area
(2) Mop up any water spilled in area
(3) Sweep area clean
(4) Put all trash and refuse in metal container

III. APPLICATION (DRILL, ILLUSTRATIONS, ANALOGIES, ORAL QUESTIONS OR ASSIGNMENTS, MAKING INVESTIGATIONS OR EXPERIMENTS, NOTE TAKING, MAKING SKETCHES, PARTICIPATING IN DISCUSSION.)

1. Review stage II reemphasizing key points.
2. Have students visit an auto body repair shop and observe workers preparing a vehicle for refinishing.
3. Discuss the various products and have students recall uses of each one.
4. Discuss safety practices in painting.

IV. VERIFICATION AND/OR EVALUATION (FINAL CHECK ON STUDENTS' COMPREHENSION OF MATERIALS PRESENTED.)

Simple Recall

1. Undercoats promote adhesion of the topcoat.
2. There are three different types of undercoats.
3. The undercoat and topcoat together make up the finish of an automobile.
4. The four basic types of topcoat materials are acrylic lacquer, acrylic enamel, alkyd enamel, and polyurethane enamel.
5. Any paint will contain pigment, binder, and solvent.
6. The rough surface of sandpaper is called the grit.
7. Sanding is the most important stage in preparation.
8. Sanding may be done by hand or power sanders.
9. Masking is done to prevent overspray.

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10. Products should be mixed according to label directions.
11. Topcoat material should always be strained into the paint gun cup.
12. Spraying technique is determined by the type of material being used.
13. Thorough cleanup of the painting equipment is essential.
14. A respirator mask should be worn when spraying.
15. All spraying should be done in a well ventilated area.

V. SUMMARY (GIVE A BRIEF ACCOUNT OF EACH TOPIC REEMPHASIZING THE IMPORTANT POINTS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENT.)

1. An automobile finish consists of the undercoat and the topcoat.
2. There are three types of undercoats: (a) primer, (b) primer - surfacer, (c) sealer.
3. There are four basic types of topcoat material: (a) acrylic lacquer, (b) acrylic enamel, (c) alkyd enamel, (d) polyurethane enamel.
4. Any paint will contain at least three ingredients: (a) pigment, (b) binder, (c) solvent.
5. Surface should be sanded thoroughly before painting.
6. Masking should be done carefully to prevent overspray.
7. Materials should be mixed and sprayed according to label directions.
8. Thorough cleanup is essential after refinishing.
9. Wear a respirator mask to protect lungs and throat.
10. All spraying should be done in a well ventilated area.

SUGGESTED READING FOR THE STUDENT:

Auto Body Repairing and Refinishing, pp. 171-172
Refinisher's Guide, pp. 1-39

The Next Lesson Is: VII-A-1(S) "Prepare Surface Refinishing Spot Repair"

SUBJECT: Automotive Finishes

INTRODUCTORY INFORMATION:

Can you imagine what your car or truck would look like without a coat of paint? It certainly wouldn't be very pretty to look at regardless of the beauty of its design. The paint not only makes a car look beautiful, but protects it from rust and corrosion as well.

GENERAL INFORMATION:

In the early days of automobile manufacturing, applying the paint or finish was a long, laborious process. Coat after coat of a mixture of lampblack and varnish were applied with a brush. Each coat had to dry thoroughly and then be hand rubbed with pumice and water before the next coat could be applied. The final coat was then hand rubbed and waxed. This process normally took from four to five weeks. The finish thus produced usually only lasted for about a year before becoming dull and badly cracked.

In the middle 1920's, a new type of paint was developed called nitrocellulose lacquer. This paint was durable and so fast drying that it eliminated the bottleneck in auto production. For the first time a vehicle could be painted with a spray gun instead of a brush. A car could be completely finished in hours, where it used to take weeks. The finish thus produced was also tough and long-lasting.

In the early 1930's, a second finish was developed, alkyd enamel. This paint was easily applied and very durable. It had several advantages over lacquers. Only two or three coats were required and it dried to a smooth, glossy finish without rubbing, even after being force-dried. Thus cut production time even further.

Continuous research and improvement of these two finishes has led to the development of acrylic lacquers and acrylic enamels. These contain a clear acrylic or polymer (plastic) fluid as the binder, which results in a fast-drying, longer lasting finish. These products are used worldwide in the auto body repair industry. The fast drying time (dust free in about 30 minutes) of acrylic enamel has made it a favorite of most auto refinishers.

A more recent innovation has been the development of the polyurethane type of finish. This paint contains a clear urethane agent as the binder. When mixed with a catalyst (or activator) and applied as a finish, this paint dries to a smooth, plastic-like film, which is extremely tough and durable.

Most modern paints, regardless of type, contain three main ingredients:

Pigment: This is what gives the paint its color and the ability to cover or hide what is underneath.

Binder: This is a relatively clear product that holds the pigment in suspension and converts it to a liquid form. It also acts much like a glue to make the pigment stick to the surface. Any clear finish is almost entirely binder.

Solvent: This ingredient makes the pigment and binder thin enough to apply. It makes the solution more fluid - less thick and viscous. In lacquer paints this solvent is known as thinner and in enamels as reducer. When the paint is applied to the surface of an automobile, these solvents evaporate completely. The pigment and binder then harden into a paint film, or topcoat, which may be less than .004 of an inch thick.

These are the three main ingredients contained in all paints. There are other ingredients, however, that may be added to change the looks or appearance of the top coat. One of the most widely used is metallics, or metalflakes. These are very small particles or flakes of metal that are suspended in the paint film. When light reflects from these particles at certain angles it gives a jewel-like appearance to the topcoat finish.

The finish of an automobile refers to the layers or coats of material that cover the bare metal. This could be compared with the layers of clothing that cover your body. On a factory finished vehicle, this usually consists of two layers:

Undercoat: The undercoat is used to provide a smooth base for the topcoat. It prevents rust and corrosion of the metal and promotes adhesion of the topcoat. Undercoats are classed in three categories.

a. Primers: primers have two basic uses. They prevent rust and promote adhesion. They are usually applied in one or more thin coats and do not require sanding before applying the topcoat.

b. Primer-Surfacers: primer-surfacer has all the same qualities of primer and is used much the same. It also serves to fill in small scratches, nicks, or other surface imperfections. Primer-surfacer may be applied to either bare metal or old finishes that have been sanded. It produces a thick film which must be sanded smooth before applying the topcoat.

c. Sealers: As the name implies, sealers are used to seal an old finish before applying a new topcoat. This prevents the new paint film from sinking into the old finish. A sealer should always be used when refinishing with a product that is different from the old finish, such as alkyd enamel over acrylic lacquer. It prevents the sand scratches from swelling and showing up in the new paint film. Sealers may be either colored or clear and require no sanding before applying

the topcoat. Sealers should never be sprayed over bare metal.

Topcoat: This is the final layer or coat of material in an automobile finish. When properly applied, it is what gives a vehicle its color and makes it pleasing to the eye. Any of the various types of paint may be used as a topcoat. Special additives may also be used in the topcoat to produce a custom effect.

Continuous development and improvement by the industry have provided today's painter with an impressive array of products for refinishing. The durability, quality, and easy application of these products make possible the fine finishes seen in the automobile refinishing industry today. In this industry, the old adage "in the good old days" certainly does not apply.

INSTRUCTOR'S PLAN VII-A-1(S)
MANIPULATIVE LESSON

TASK:	Prepare Surface for Refinishing Spot Repair
AIM:	The student will be able to prepare the surface of a previously damaged area for top coat application.
TOOLS AND EQUIPMENT:	Compressed air, air hose, suction type paint gun, mixing paddle, sanding blocks, water bucket
MATERIALS:	Sandpaper 800-grit, 240-grit, 400 wet-or-dry, lacquer primer-surfacer, lacquer thinner, clean rags, water metal conditioner
TEACHING AIDS:	
REFERENCES:	Auto Body Repairing and Repainting, pp. 171-172 Automotive Refinishing Principles and Techniques, chs. 1-3, 5-10 Refinisher's Guide, pp. 1-39
PREREQUISITE EXPERIENCE OF THE LEARNER:	The student must have read the information sheets covering spot repair preparation and must have passed the verification stage of lesson VII-A-1(I) "Preparation For Painting"
CHECKING STANDARDS:	1. Selection of proper materials. 2. Handle tools, equipment, and materials properly. 3. Proper preparation for application of lacquer primer-surfacer. 4. Proper application of the lacquer primer-surfacer. 5. Proper finishing of lacquer primer-surfacer.

I. PREPARATION (OF THE LEARNER - MOTIVATION)

A thoroughly clean surface to which paint will adhere is necessary in order for an applied finish to look good upon application and last for a respectable length of time. Dirt, oil, grease, wax, silicone, moisture, and rust must be removed from the prepared surface. Any of these elements can and will quickly destroy the durability and appearance of the topcoat.

This lesson is on the proper procedures to follow in preparing a repair area for and the application of primer-surfacer. The test will be on the student's ability to properly prepare the repair area, apply lacquer primer-surfacer, and finish the surface.

II. PRESENTATION (OF THE LEARNER-MOTIVATION)

STEPS	KEY POINTS (THINGS TO REMEMBER TO DO OR SAY)
1. Determine Condition Of Surrounding Paint	1. Check for sandscratches 2. Check for flaking of old finish 3. Determine type of finish on panel a. Rub a small spot of the finish where the repairs will be made with a lacquer thinner dampened rag b. If the finish softens, it is lacquer c. It it does not, it is enamel Note: Since this lesson is over preparing for a spot repair, the repair will be made in acrylic lacquer
2. Order Needed Refinishing Materials	1. Locate paint identification number on vehicle identification plate 2. Write down number 3. Locate corresponding color code number in paint chip color book a. By year model b. By make c. Double check by comparing color chip with car color 4. Order the color and amount of paint needed
3. Mask Around Surrounding Panel	1. Mask off nonpainted areas 2. Mask off adjacent panels 3. Prevent overspray from covering nonpainted areas 4. Mask using masking paper and masking tape a. Place masking tape over and along edge of nonpainted areas b. Be sure to not let tape lap over onto painted areas Note: It is better to get a little paint on the chrome than to let the tape cover a painted area c. Cover the large nonpainted areas with masking paper; seal edges
4. Featheredge Broken Areas	1. Remove the rough edge left by grinding process in plastic application a. Sand well back into paint to attain a gradual slope to the bare metal

b. Keep hand flat or use a rubber block
c. Use 240 grit sandpaper

2. Finish by light sanding with 400-grit sandpaper

5. Treat Bare Metal Area

1. Use phosphate-type metal treatment conditioner
2. Use according to directions
   a. Wear protective rubber gloves and safety glasses
   b. Protection against chemicals in metal conditioner
3. Allow to dry thoroughly

   Note: Apply primer-surfacer to bare metal areas within 30 minutes after metal conditioning treatment

6. Fill Spray Gun With Primer-Surfacer

1. Use suction type spray gun
2. Remove cup from spray gun
   a. Turn the lockscrew counterclockwise (to the left)
   b. Loosen locking lug grips
3. Check to make sure the paint cup is clean
   a. Wipe out any residue in cup
   b. Use a clean white shop towel
4. Stir primer-surfacer thoroughly
   a. Use a paint stirring paddle
   b. Dissolve all particles from bottom of primer-surfacer container
5. Pour paint cup 1/3 full of primer-surfacer
6. Replace lid on primer-surfacer can
7. Fill paint cup to full mark with appropriate lacquer thinner
   a. Refer to refinishing guide for appropriate thinner
   b. Appropriate thinner is dependent upon shop conditions; temperature and humidity
8. Stir the mixture thoroughly
   a. Use a paint stirring paddle
   b. Mix two together completely
9. Replace cup on paint gun
10. Set the line air pressure at the regulator
    a. Set the line pressure at 40 p. s. i.
    b. Adjust by turning the wingnut adjusting screw on the air regulator in the appropriate direction

11. Attach the air hose to the paint gun hose adaptor

7. Dust Area

1. The area is dusted with the panel gun to remove dust and dirt
2. Pull the trigger halfway back to get air only
   a. Blow off entire area
   b. Wear safety goggles
   c. Avoid touching the air with hands
3. Blow repair area completely to remove specks of debris from small pits

8. Set Air Pressure at 25 to 35 lbs at the Gun

1. If line at the gun is equipped with metering gauge set gun pressure at 30 psi
2. There will be a pressure drop from the wall regulator to the gun due to pressure in the hose

9. Adjust Spray for Small Pattern

1. Place a sheet of paper 28" x 34" on wall
2. Hold gun at a distance of 6"-8" away
3. Pull trigger all the way back, then release at once
   a. This will show shape and texture of pattern
   b. If pattern appears coarse or too wet, increase air pressure 5 lbs

   Note: Remember-excessive air pressure wastes materials
   c. If pattern is too fine or dry looking either open the fluid valve slightly or reduce air pressure 5 lbs
4. Adjust spray pattern for spot repair
   a. Turn the pattern control valve to the right or clockwise to reduce pattern size
   b. The pattern should be no more than 5" wide when gun is held 6-8" from surface

10. Apply Medium Coats

1. Start at bottom of repair area on either side
2. Start gun moving just before pulling trigger
   a. Hold gun at proper distance 6-8" from surface
   b. Hold the gun level, keeping it perpendicular and parallel to the surface

c. Move the gun parallel to the surface

Note: Do not arc the gun when spraying

d. Move the gun in a steady deliberate pass about 1' per second

e. Release the trigger at end of each spray pattern length and pull trigger again upon returning to the edge of the refinish area from opposite direction

f. Second pass is made in opposite direction, overlapping half of the previous spray width

g. Continue back and forth until the repair area is covered with one coat

h. Primer-surfacer should not extend beyond featheredged area

Note: Allow this single coat to flash or turn dull before adding another coat

Note: For a double coat repeat this process immediately before allowing first coat to flash

i. Apply additional coats as the coats dry, extending slightly beyond previous coats

j. Final coat should be allowed to dry 20-30 minutes before sanding, depending on temperature and humidity

k. Apply no more material than is needed to fill featheredge spot

l. Generally four medium coats will be sufficient

11. Allow Dry Time

1. Dry time is from 20-30 minutes depending upon temperature and humidity
2. This time can be spent in working other areas
3. Apply putty to deep scratches

Note: Use no more putty than necessary. Putty is not a cure all or a filler

12. Block Sand Repair Area

1. Block repair area with 80D grit sandpaper and appropriate sanding block
   a. Use rubber block for small repair areas
   b. Use 10-12" block for medium repair areas
   c. Use 18" block for large repair areas

2. Block area to lower the high spots and leave the primer and putty in the low spots or scratches
   Note: Do not sand area by hand or over sand area
3. Dust area with spray gun

13. Check for Surface Flatness
1. Use clean white shop towel or thin cotton glove
2. Lay hand on surface flat
3. Feel entire length of repair area for low or high spots

14. Reprimer-Surface Area
1. Use same techniques as before
2. Apply only enough material to fill sand-scratches
3. Primer-surface just beyond previously primed area
4. Let primer-surfacer dry 20-30 minutes
5. Closely inspect area for sandscratches
6. All the sandscratches will show through the topcoat if not removed

15. Reblock Area
1. Use sanding block, 240 grit wet-or-dry paper, and water
2. Feed water supply over repair area as blocking progresses
   Note: Water washes the residue from the sandpaper grit and allows better cutting action
3. Block entire area
4. Remove all high spots
   Note: When blocking and a high metal area appears, the high metal area will have to be brought down or the paper will cut the primer-surfacer from around the high spot. This will result in a higher metal spot with a low area around it

16. Recheck for Flatness
1. Feel repaired area with flat hand on towel or cotton glove
2. Skylight the surface
   a. Place the repair so the light source is running parallel with the repaired area
   b. Low spots will show when observer backs off and looks down the repaired area into the light source

17. Reprimer-Surface
1. Reprime any bare metal areas or bare plastic areas
2. Use only enough material to cover areas
3. Let dry completely

18. Finish Sand
1. Finish sand with 400-grit sandpaper to remove any scratches in primer
2. After sanding with 400 there should be no scratches visible
3. Make sure sanding progresses 2-3" outside of primed area

19. Compound Surrounding Area
1. Provide a clean true color to match
2. Compound two to three feet around the repair area
   Note: Will probably be better to compound the entire panel
   a. Use a clean white shop towel
   b. Check the rag to make sure it does not contain a foreign object
   c. Compound the finish
3. If the finish has a high metallic content, compounding will not restore its original appearance
4. The primer-surfacer should not be compounded. If the primer-surfacer has been compounded, lightly sand the surface with 400 grit wet-or-dry and wipe the area with a tack rag

20. Clean Spray Gun
1. Clean the paint gun
   a. Remove the paint cup
   b. Lift suction tube above liquid level
   c. Unscrew the air nozzle about three turns to the left (counterclockwise)
   d. Hold a clean cloth over the air cap
   e. Pull the trigger
   f. This forces primer from the gun back into cup
   g. Pour unused primer back into primer-surfacer can
   h. Pour paint cup 1" deep with clean thinner
   i. Replace cup onto paint gun
   j. Retighten air nozzle turn to right (clockwise)

		k. Pull the trigger to flush the paint left in the gun 2. Clean the nozzle a. Remove b. Soak in lacquer thinner c. Dry with compressed air 3. Thoroughly clean cup and gun a. Use lacquer thinner b. Use soft cleaning brush c. Remove all traces of primer-surfacer 4. Pour out dirty thinner 5. Pour 1" of clean thinner in paint cup 6. Place nozzle in cup 7. Replace cup on paint gun 8. Replace gun in storage cabinet
21.	Return Tools and Equipment to Storage	1. Use solvent to clean the tools and equipment 2. Bench brush to clean benches and tables 3. Clean rags for wiping the work area and equipment clean 4. Sorb all for oil spots on floor 5. Floor broom to sweep up 6. Dust pan to pick up residue
22.	Clean Up Work Stall	1. Make sure all equipment is returned to storage room 2. Secure all hoses and valves 3. Wipe all shop equipment clean of dust and dirt 4. Clean goggles with soap and water

III. APPLICATION (PRACTICE BY LEARNER UNDER CLOSE SUPERVISION)

1. Students to practice mixing primer-surfacer, applying primer-surfacer with a suction type spray gun, and finishing primer-surfacer for painting using job and task sheets VII-A-1(J)
2. Observe and reteach, if the need arises, the repair area preparation process.
3. Check students for key points.
4. Have students repeat key points as they perform task.

IV. VERIFICATION AND/OR EVALUATION (CHECK ON STUDENT'S ABILITY)

Put students on their own to perform task (performance test).

V. SUMMARY (TELL THE STEPS ON PROCEDURE AS TO WHAT, HOW, AND WHY. REVIEW CHECKING STANDARDS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENTS)

1. Repeat the steps in Stage II.
2. Emphasize the key points in Stage II.
3. Emphasize safety.

SUGGESTED READING FOR THE STUDENT:

Auto Body Repairing and Repainting, pp. 159-202
Automotive Refinishing Principles and Techniques, pp. 3-69
Refinisher's Guide, pp. 7-33

The Next Lesson Is: VII-A-2(S), "Prepare Surface for Complete Panel Refinishing"

JOB:	Prepare Surface for Refinishing Spot Repair
MATERIALS:	Sandpaper (80D, 240, and 400 grits), primer-surfacer, lacquer, thinner, clean rags, water source, metal conditioner, paddles, rubbing compound, brush, polishing cloth, masking tape, masking paper
TOOLS AND EQUIPMENT:	Air source, spray gun, polishing buffer, pad cleaner, blow gun, rubber sanding block, rubber gloves, safety glasses, respirator mask
GENERAL INSTRUCTIONS:	Complete each task exactly as outlined to insure satisfactory job.

PROCEDURES AND/OR TASKS:

VII-A-1a(TS)	Initial Preparation
VII-A-1b(TS)	Mask Surrounding Area
VII-A-1c(TS)	Prepare for Undercoats
VII-A-1d(TS)	Apply Undercoats
VII-A-1e(TS)	Block Sand Area
VII-A-1f(TS)	Finish Preparation
VII-A-1g(TS)	Clean Up

TASK: Initial Preparation

JOB: Prepare Surface For Refinishing Spot Repair

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Lacquer thinner, rags, paint chip color book

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Locate Paint Identification Number	1. Ford Motor Company Vehicles a. On rear face of left front door inside panel just below door lock b. On left front in side door jamb just below striker plate 2. General Motors Vehicles a. On code plate on cowl top panel under hood b. Right or left side of upper part of radiator core support 3. Chrysler Corporation Vehicles a. On code plate on left front fender splash apron or wheel housing b. Right or left side of upper part of radiator core support 4. American Motors Vehicles a. On plate on left front door hinge pillar b. Rear face of left front door inside panel just below door lock assembly 5. May be a number, letter, or a combination of the two 6. May be an abbreviated word, such as pt., pnt., or col.
2. Locate Corresponding Color Code Number In Color Chip Book	1. Locate by year, make, and model 2. Determine correct mixing number for acrylic lacquer
3. Assemble All Materials Needed	1. Obtain correct type and amount of paint needed 2. Obtain recommended thinning solvents for materials used and shop conditions 3. Obtain any other materials needed

STEPS	KEY POINTS
	a. Sandpaper b. Masking materials c. Compound d. Rags e. Strainers, paddles, etc.

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TASK: Mask Surrounding Area

JOB: Prepare Surface For Refinishing Spot Repair

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Soap, water, rags, cleaning solvent, 3/4" masking tape, masking paper

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Prepare Vehicle	1. Move vehicle to wash area 2. Wash complete vehicle with soap and water 3. Wash area to be refinished with a cleaning solvent a. Used solvent dampened rag b. Clean small areas at a time c. Wipe immediately with clean dry rag d. Clean well out into the surrounding area 4. Use clean rags and blow gun to dry vehicle and remove all traces of water 5. Move vehicle to paint booth or well-ventilated area
2. Mask Off Repaired Area a. Tape	1. Determine size of refinish area 2. Mask off surrounding panels a. Use single strip of tape to outline edges b. Make sure tape does not overlap onto the surface that is to be painted c. Use tape to cover any moldings or emblems that cannot be removed d. Several widths of tape for various tasks
b. Masking Paper	1. Use paper/tape dispensing machine 2. Use width of paper applicable to masking needs 3. Apply taped edge of masking paper along previously applied tape a. Overlap half the width of tape b. Press tape down firmly 4. Completely cover areas that need to be protected 5. Seal all seams or joints in paper with tape 6. Tape down loose ends of paper

STEPS	KEY POINTS
	a. Small pieces approximately one inch long b. Space about every 24 inches c. Prevents paper from blowing over onto wet paint

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TASK: Prepare For Undercoats

JOB: Prepare Surface For Refinishing Spot Repair

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Sanding block, 80D and 240 grit sandpaper, metal conditioner, clean rags, rubber gloves, safety glasses

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Feather Edge Repairs	1. Use 80D grit sandpaper and sanding block 2. Taper old paint and primer edge back from repaired spot a. Start where the bare metal and the old paint meet b. Tapered area should extend out into the old surface approximately two inches c. Keep block flat to surface 3. Feather edge completely around edges of repaired spot Note: Any edge not feathered will show up in the new paint film 4. Replace the 80D paper on the sanding block with 220 grit 5. Completely sand over the feathered edges 6. Sand out onto the old surface approximately two inches beyond the feathered edges 7. Sand out all the scratches left by the 80D grit paper
2. Treat Bare Metal Areas	1. Use phosphate-type metal treatment conditioner 2. It is important to follow manufacturer's recommendations 3. Most conditioners are applied in the same manner 4. Use all safety precautions a. Wear rubber gloves b. Wear safety glasses or goggles c. Use respirator mask 5. Typical application a. Apply solution with brush or rag b. Scrub metal with steel wool or stiff brush

STEPS	KEY POINTS
	c. Keep metal wet with solution while scrubbing d. While metal is still wet, wipe thoroughly with clean rags Note: If sludge forms before wiping is completed, rewet and wipe completely clean e. Allow to dry for ten minutes before proceeding f. Apply primer-surfacer within thirty minutes after metal conditioning is completed

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TASK: Apply Undercoats

JOB: Prepare Surface For Refinishing Spot Repair

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Lacquer primer-surfacer, lacquer thinner, clean rags, stirring paddle, spray gun

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Prepare Undercoat	1. Stir the primer-surfacer thoroughly a. Use paint stirring paddle b. Make sure all solids are stirred up from bottom of container Note: Failure to do this will lessen the binding and filling qualities of the material and could result in the undercoat peeling off 2. Mix primer-surfacer to spraying consistency a. Follow label directions as to primer-surfacer/thinner ratio b. Use appropriate thinner for shop and temperature conditions 3. Stir thoroughly to completely mix the solution
2. Prepare Spray Gun	1. Remove paint cup from gun a. Turn locking lever to the left, or counterclockwise, to loosen the locking lug grips b. Hold paint cup firmly in one hand c. With other hand, rotate gun assembly slightly to the left and remove from paint cup 2. Set cup on paint bench 3. Pour paint cup three-fourths full of primer-surfacer/thinner mixture Note: Do not strain undercoat mixtures 4. Replace paint cup on gun very carefully to avoid spilling
3. Adjust Air Pressure	1. Adjust pressure at air transformer or regulator a. Turn the wingnut or adjusting knob on

STEPS	KEY POINTS
	the regulator in the appropriate direction (1) To the right, clockwise, increases pressure (2) To the left, counterclockwise, decreases pressure b. Adjust to 40 psi on gauge
	2. Adjust pressure at gun a. If gun is equipped with a metering valve or regulator, adjust to read 35 psi at the gun b. If the gun is not so equipped, adjust as follows: (1) Pull gun trigger half-way back to open air valve (2) Watch gauge on wall regulator (3) With trigger still held back, adjust regulator until gauge reads 35 psi (4) Release trigger Note: As the trigger is released, the pressure reading will build up slightly. The difference in these two readings indicates the pressure drop at the gun
4. Adjust Gun	1. Adjust spray pattern a. Tape a piece of 36" masking paper 24" long on wall b. Hold gun at 6 to 8" distance from paper c. Pull trigger all the way back, then release at once d. Pattern should be solid, oval shape approximately 5" wide e. Top valve on paint gun controls width of pattern (1) Turn to right to decrease width (2) Turn to left to increase width
	2. Adjust fluid output a. Bottom valve on gun controls the amount of fluid being sprayed (1) Turn to right to decrease fluid (2) Turn to left to increase fluid b. Spray another pattern on masking paper test piece (1) If pattern appears too coarse or wet, decrease fluid output

STEPS	KEY POINTS
	(2) If pattern appears too fine or dry looking, increase the fluid output
5. Apply Base Coat	1. Start at either side of the repair area 2. Begin moving the gun just a split second before pulling the trigger a. Hold gun at the proper distance, 6-8" from the surface b. Hold gun level, keeping it perpendicular and parallel to the surface 3. Pull the trigger all the way back 4. Move the gun in a steady deliberate pass, at about one foot per second 5. Release the trigger at the end of each spraying pass 6. Second pass is made moving in the opposite direction, overlapping half of the previously sprayed pass 7. Release the trigger at the end of each pass and pull again upon returning to the edge of repair area from the opposite direction 8. Continue back and forth until repair area is covered with one coat a. Undercoat should not extend beyond the sanded area b. Allow base coat to flash or turn dull before applying next coat
6. Apply Filler Coats	1. Apply each coat in the same manner as base coat a. Allow each coat to flash before proceeding b. Extend each new coat slightly beyond previous coat 2. Apply no more material than is necessary for bringing repaired area up to level 3. Generally 4 medium coats will be sufficient 4. Allow final coat to completely dry before proceeding

TASK: Block Sand Area

JOB: Prepare Surface For Refinishing Spot Repair

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Rubber sanding block, sandpapers (80D, 240, and 400 grit), water source, clean rags, spray gun with undercoat

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Load Sanding Block	1. Use 6, 12, or 18 inch block a. Block should be made of rubber b. Size of repairs determines size of block 2. Place 2 strips of 80D grit sandpaper on block a. More than 2 strips will reduce the effectiveness of the block b. Different blocks use different methods of attaching sandpaper c. Insert sandpaper with grit or cutting side of block
2. Sand Area	1. Use straight strokes the length of the repaired spot 2. Keep block flat to the surface 3. Do not sand out onto the repaired area 4. Sand entire area using horizontal strokes 5. Sand entire area using vertical strokes 6. Use moderate pressure of hand on block
3. Inspect Sanded Surface	1. Dust off sanded area with blow gun 2. Lay palm of hand flat on surface 3. Rub entire surface of sanded area 4. Feel for any high spots in repairs and any rough spots in primer-surfacer 5. Resand if necessary
4. Apply Primer-Surfacer	1. Use same procedure and technique as before 2. Apply 3 full, medium-wet coats a. Allow to flash between coats b. Extend each coat a little past the preceding one 3. Allow last coat to dry at least 30 minutes before proceeding Note: A heat lamp or drying light may be used to speed up drying time. Use a low

STEPS	KEY POINTS
	heat setting and position unit at least 3 feet from surface area to prevent blistering
5. Block Sand With Water	1. Insert 2 strips of 240 grit wet or dry sandpaper into rubber sanding block 2. Apply water to the undercoated area a. Use bucket and sponge b. Use water hose with low pressure 3. Use straight even strokes that run the length of the repaired spot 4. Use light hand pressure on block 5. Block sand entire area a. Horizontal strokes b. Vertical strokes 6. Replace sandpaper with 2 strips of 400 grit paper 7. Block sand entire sanded area a. Use same procedures as when using 240 grit b. Extend sanding approximately 2 inches beyond previously sanded area
6. Inspect Surface	1. Wipe off water with clean rags 2. Use blow gun to remove all traces of water a. From surface b. From underneath any moldings, emblems, or body seams in the sanded area 3. Visually inspect area a. For scratches b. For rough spots in primer 4. Resand if necessary

TASK: Finish Preparation

JOB: Prepare Surface For Refinishing Spot Repair

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Rubbing compound, clean rags, water, power buffer, pad cleaner

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Select Materials	1. Use a fast-cut rubbing compound Note: If compound has thickened or dried out in container, use a small amount of clean water to thin to proper consistency 2. Use clean white, lint-free cloths a. Cheese cloth b. Polishing cloth c. Terry cloth or towel material 3. Use power buffer
2. Compound Area a. By Hand	1. Wet cloth in clean water 2. Wring out excess water but leave cloth damp 3. Fold cloth into a hand-size pad 4. Apply small amount of compound to pad 5. Apply to painted surface a. Use straight even strokes b. Use sufficient pressure to insure thorough cleaning of old paint film 6. Rub small areas at a time 7. Overlap strokes to eliminate streaks Note: Do not compound sanded area. Rub only up to edge of sanding marks 8. As one side of pad becomes soiled, refold to a clean side 9. Continue rubbing until entire area of old paint has been cleaned a. At least 24 inches out from edges of sanded area b. Around complete perimeter of repaired spot 10. Use clean cloth to rub off all remaining traces of compound
b. With Power Buffer	1. Use air or electric powered buffer

STEPS	KEY POINTS
	2. Replace or clean polishing pad on buffer 3. Dip clean cloth into compound container 4. Apply small amount of compound to painted surface Note: Compound may also be applied to surface with a small brush or with the finger tips 5. Turn on buffer and bring into contact with the compound Note: Use a slow-speed electric buffer or, if air powered, use with low air pressure. Buffer should not exceed 1000-1400 rpm 6. Use light pressure on buffer 7. Compound entire area of old paint surrounding sanded area 8. Keep buffer pad flat on surface 9. Clean polishing pad often to prevent compound and old paint buildup in pad Caution: Use care when compounding around panel edges or sharply curved creases to avoid burning paint
3. Inspect Prepared Area	1. Use clean white cloth to remove any remaining traces of compound 2. Dust off area with blow gun 3. Blow all dust and compound off of any masking paper surrounding the area 4. Check for streaks 5. Check for burned spots 6. Repeat compounding operation if necessary until entire area is thoroughly cleaned and ready for refinishing

TASK: Clean Up

JOB: Prepare Surface For Refinishing Spot Repair

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Lacquer thinner, wash brush, clean rags

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Clean Gun	1. Return all unused undercoat material to original container and cap tightly 2. Pour one inch of clean lacquer thinner into paint gun cup 3. Use wash brush to clean all traces of primer-surfacer from cup Caution: Lacquer thinner is very flammable and cleaning should be done in a well-ventilated area. Avoid prolonged breathing of fumes 4. Pour out dirty thinner 5. Pour one inch of clean thinner into cup 6. Dip brush into cup and use to clean outside of cup and gun body 7. Replace gun onto cup 8. Work trigger of gun back and forth until all thinner has been sprayed out of cup 9. Wipe off complete outside of gun and cup with solvent dampened rag 10. Remove cup from gun and pour 1 inch of clean thinner into cup 11. Remove air cap from gun and place in cup 12. Replace cup on gun 13. Return gun to storage locker
2. Clean Area	1. Wipe off all tools and equipment and return to storage area 2. Make sure caps are on all material containers and return to storage area 3. Sweep up area and put all trash and empty containers in metal trash container 4. Mop up all water in work area

INSTRUCTOR'S PLAN VII-A-2(S)
MANIPULATIVE LESSON

TASK:	Prepare Surface for Complete Panel Refinishing
AIM:	The student will be able to prepare the surface of a previously damaged area for top coat application.
TOOLS AND EQUIPMENT:	Compressed air, air hose, suction type paint gun, mixing paddle, sanding blocks, water bucket
MATERIALS:	Sandpaper 80 D grit, 360-grit, 400 wet or dry, lacquer primer-surfacer, lacquer thinner, clean rags, water, metal conditioner
TEACHING AIDS:	
REFERENCES:	Auto Body Repairing and Repainting, pp. 171-172 Automotive Refinishing Principles and Techniques, pp. 3-69 Refinisher's Guide, pp. 7-33
PREREQUISITE EXPERIENCE OF THE LEARNER:	The student must have read the information sheets covering panel repair preparation and must have passed the verification stage of lesson VII-A-1(I) "Preparation For Painting"
CHECKING STANDARDS:	1. Selection of proper materials. 2. Handle tools, equipment, and materials properly. 3. Proper preparation for application of lacquer primer-surfacer. 4. Proper application of the lacquer primer-surfacer. 5. Proper finishing of lacquer primer-surfacer.

I. PREPARATION (OF THE LEARNER - MOTIVATION)

A thoroughly clean surface to which paint will adhere is necessary in order for an applied finish to look good upon application and last for a respectable length of time. Dirt, oil, grease, wax, silicone, moisture, and rust must be removed from the prepared surface. Any of these elements can and will quickly destroy the durability and appearance of the topcoat.

This lesson is on the proper procedures to follow in preparing a repaired panel for and the application of primer-surfacer. The test will be on the student's ability to properly prepare the repaired panel, apply lacquer primer-surfacer, and finish the surface.

II. PRESENTATION (OF THE SKILLS)

STEPS	KEY POINTS (THINGS TO REMEMBER TO DO OR SAY)
1. Determine Condition of Surrounding Panel	1. Check for sandscratches 2. Check for flaking of old finish

3. Determine type of finish on panel
   a. Rub a small spot of the finish where the repair will be made with a lacquer thinner dampened rag
   b. If the finish softens, it is lacquer
   c. If it does not, it is enamel

   Note: Panel refinishing will be made in acrylic lacquer

2. **Order Needed Refinishing Materials**
   1. Locate paint identification number on vehicle identification plate
   2. Write down number
   3. Locate corresponding color code number in paint chip color book
      a. By year, model
      b. By make
      c. Double check by comparing color chip with car color
   4. Order the color and amount of paint needed

3. **Mask Around Surrounding Panel**
   1. Mask off nonpainted areas
   2. Mask off adjacent panels
   3. Prevent overspray from covering nonpainted areas
   4. Mask using masking paper and masking tape
      a. Place masking tape over and along edge of nonpainted areas
      b. Be sure to not let tape lap over onto painted areas

      Note: It is better to get a little paint on the chrome than to let the tape cover a painted area
      c. Cover the large nonpainted areas with masking paper; seal edges

4. **Featheredge Broken Areas**
   1. Remove the rough edge left by grinding process in plastic application
      a. Sand well back into paint to attain a gradual slope to the bare metal
      b. Keep hand flat or use a rubber block
      c. Use 240 grit sandpaper
   2. Finish by light sandpaper

5. **Treat Bare Metal Area**
   1. Use phosphate-type metal treatment conditioner

2. Use according to directions
   a. Wear protective rubber gloves and safety glasses
   b. Protection against chemicals in metal conditioner
3. Allow to dry thoroughly
   Note: Apply primer-surfacer to bare metal areas within 30 minutes after metal conditioning treatment

6. Fill Spray Gun With Primer-Surfacer

1. Use suction type spray gun
2. Remove cup from spray gun
   a. Turn the lockscrew counterclockwise (to the left)
   b. Loosen locking lug grips
3. Check to make sure the paint cup is clean
   a. Wipe out any residue in cup
   b. Use a clean white shop towel
4. Stir primer-surfacer thoroughly
   a. Use a paint stirring paddle
   b. Dissolve all particles from bottom of primer-surfacer container
5. Pour paint cup 1/3 full of primer-surfacer
6. Replace lid on primer-surfacer can
7. Fill paint up to full mark with appropriate lacquer thinner
   a. Refer to refinishing guide for appropriate thinner
   b. Appropriate thinner is dependent upon shop conditions; temperature and humidity
8. Stir the mixture thoroughly
   a. Use a paint stirring paddle
   b. Mix two together completely
9. Replace cup on paint gun
10. Set the line air pressure at the regulator
    a. Set the line pressure at 40 psi
    b. Adjust by turning the wingnut adjusting screw on the air regulator in the appropriate direction
11. Attach the air hose to the paint gun hose adaptor

7. Dust Area

1. The area is dusted with the paint gun to remove dust and dirt

2. Pull the trigger halfway back to get air only
   a. Blow off entire area
   b. Avoid touching the air with hands
3. Blow repair area completely to remove specks of debris from small pits

8. **Set Air Pressure at 25 to 35 lbs at the Gun**

1. If line at the gun is equipped with metering gauge set gun pressure at 30 psi
2. There will be a pressure drop from the wall regulator to the gun due to pressure in the hose

9. **Adjust Spray for Large Pattern**

1. Place a sheet of paper 28" x 34" on wall
2. Hold gun at a distance of 6" - 8" away
3. Pull trigger all the way back then release at once
   a. This will show shape and texture of pattern
   b. If pattern appears coarse or too wet, increase air pressure 5 lbs

   Note: Remember-excessive air pressure wastes material
   c. If pattern is too fine or dry looking, either open the fluid valve slightly or reduce air pressure 5 lbs
4. Adjust spray pattern for complete panel painting
   a. Turn the pattern control valve to the left or counterclockwise to increase pattern size
   b. The pattern should be no more than 7-8" wide when gun is held 6-8" from surface

10. **Apply Medium Coats**

1. Start at bottom of the panel on either side
2. Start gur moving just before pulling trigger
   a. Hold gun at proper distance 6-8" from surface
   b. Hold the gun level, keeping it perpendicular and parallel to the surface
   c. Move the gun parallel to the surface

   Note: Do not arc the gun when spraying
   d. Move the gun in a steady deliberate pass about 1' per second

e. Release the trigger at end of each spray pattern length and pull trigger again upon returning to the edge of the panel from opposite direction
f. Second pass is made in opposite direction, overlapping half of the previous spray width
g. Continue back and forth until the repaired panel is covered with one coat
h. Primer-surfacer should not extend beyond featheredged area

Note: Allow this single coat to flash or turn dull before adding another coat

Note: For a double coat repeat this process immediately before allowing first coat to flash

i. Apply additional coats as the coats dry, extending slightly beyond previous coats
j. Final coat should be allowed to dry 20-30 minutes before sanding, depending on temperature and humidity
k. Apply no more material than is needed to fill featheredged spot
l. Generally 4 medium coats will be sufficient

11. Allow Dry Time

1. Dry time is from 20-30 minutes depending upon temperature and humidity
2. This time can be spent in working other areas
3. Apply putty to deep scratches

Note: Use no more putty than necessary. Putty is not a cure all or a filler

12. Block Sand Repair Area

1. Block repaired area with 80 D grit sandpaper and appropriate sanding block
   a. Use rubber block for small repair areas
   b. Use 10-12" block for medium repair areas
   c. Use 18" block for large repair areas
2. Block area to lower the high spots and leave the primer and putty in the low spots or scratches

Note: Do not sand area by hand or over sand area

3. Dust area with spray gun

13.	Check for Surface Flatness	1. Use clean white shop towel or thin cotton glove 2. Lay hand on surface flat 3. Feel entire length of repair area for low or high spots
14.	Reprimer-Surface Area	1. Use same techniques as before 2. Apply only enough material to fill sand-scratches 3. Primer-surface just beyond previously primed area 4. Let primer-surfacer dry 20-30 minutes 5. Closely inspect area for sandscratches 6. All the sandscratches will show through the topcoat if not removed
15.	Reblock Area	1. Use sanding block, 360 grit wet-or-dry paper, and water 2. Feed water supply over repair area as blocking progresses Note: Water washes the residue from the sandpaper grit and allows better cutting action 3. Block entire area 4. Remove all high spots Note: When blocking and a high metal area appears, the high metal area will have to be brought down or the paper will cut the primer-surfacer from around the high spot. This will result in a higher metal spot with a low area around it
16.	Recheck for Flatness	1. Feel repaired area with flat hand on towel or cotton glove 2. Skylight the surface a. Place the repair so the light source is running parallel with the repaired area b. Low spots will show when observer backs off and looks down the repaired area into the light source
17.	Reprimer-Surfacer	1. Reprime any bare metal area or bare plastic areas 2. Use only enough material to cover areas 3. Let dry completely

18. Finish Sand

1. Finish sand with 400-grit sandpaper to remove any scratches in primer
2. After sanding with 400 there should be no scratches visible
3. Make sure complete panel is sanded

19. Clean Spray Gun

1. Clean the paint gun
   a. Remove the paint cup
   b. Lift suction tube above liquid level
   c. Unscrew the air nozzle about three turns to the left (counterclockwise)
   d. Hold a clean cloth over the air cap
   e. Pull the trigger
   f. This forces primer from the gun back into cup
   g. Pour unused primer back into primer-surfacer can
   h. Pour paint cup 1" deep with clean thinner
   i. Replace cup onto paint gun
   j. Retighten air nozzle turn to right (clockwise)
   k. Pull the trigger to flush the paint left in the gun
2. Clean the nozzle
   a. Remove
   b. Soak in lacquer thinner
   c. Dry with compressed air
3. Thoroughly clean cup and gun
   a. Use lacquer thinner
   b. Use soft cleaning brush
   c. Remove all traces of primer-surfaces
4. Pour out dirty thinner
5. Pour 1" of clean thinner in paint cup
6. Place nozzle in cup
7. Replace cup on paint gun
8. Replace gun in storage cabinet

20. Return Tools and Equipment to Storage

1. Use solvent to clean the tools and equipment
2. Bench brush to clean benches and tables
3. Clean rags to clean equipment and work area
4. Sorb all for oil spots on floor
5. Floor broom to sweep up
6. Dust pan to pick up residue

21. Clean Up Work Stall
    1. Make sure all equipment is returned to storage room
    2. Secure all hoses and valves
    3. Wipe all shop equipment clean of dust and dirt
    4. Clean goggles with soap and water

III. APPLICATION (PRACTICE BY LEARNER UNDER CLOSE SUPERVISION)

1. Students to practice mixing primer-surfacer, applying primer-surfacer with a suction type spray gun, and finishing primer-surfacer for painting using job and task sheets VII-A-2(J).
2. Observe and reteach, if the need arises, the repair area preparation process.
3. Check students for key points.
4. Have students repeat key points as they perform task.

IV. VERIFICATION AND/OR EVALUATION (CHECK ON STUDENT'S ABILITY)

Put students on their own to perform task (performance test).

V. SUMMARY (TELL THE STEPS ON PROCEDURE AS TO WHAT, HOW, AND WHY. REVIEW CHECKING STANDARDS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENTS)

1. Repeat the steps in Stage II.
2. Emphasize the key points in Stage II.
3. Emphasize safety.

SUGGESTED READING FOR THE STUDENT:

Auto Body Repairing and Repainting, pp. 159-202
Automotive Refinishing Principles and Techniques, pp. 3-69
Refinisher's Guide, pp. 7-33

The Next Lesson Is: VII-A-3(S), "Prepare Surface for Overall Refinish of Topcoat"

JOB: Prepare Surface for Complete Panel Refinishing

MATERIALS: Sandpaper (80D, 240, 400 grits), primer - surfacer, lacquer thinner, clean rags, paddles, metal conditioner, water, masking tape, masking paper, tac rag

TOOLS AND EQUIPMENT: Air source, spray gun, blow gun, rubber sanding block

GENERAL INSTRUCTIONS: This job is much like preparing the surface for spot refinishing except that no compounding is done. Follow the steps to each task carefully.

PROCEDURES AND/OR TASKS:

VII-A-2a(TS)	Determine Condition of Paint on Panel
VII-A-1a(TS)	Initial Preparation
VII-A-2b(TS)	Mask Off Adjoining Panels
VII-A-1c(TS)	Prepare for Undercoats
VII-A-1d(TS)	Apply Undercoats
VII-A-2c(TS)	Finish Sand Panel
VII-A-2d(TS)	Final Preparations
VII-A-1g(TS)	Clean Up

TASK: Determine Condition of Paint on Panel

JOB: Prepare Surface for Complete Panel Refinishing

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT:

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Check for Sandscratches	1. Look for scratches made by the metal grinding process 2. These scratches must be removed by featheredging
2. Check for Flaking of Old Finish	1. Try to scrape off the old finish with your fingernail a. If the paint flakes off it is not bonded properly and must be completely removed b. Material added over flakey paint will flake off also 2. The paint must be featheredged back until flaking stops
3. Determine Type of Finish on Panel	1. Rub a small spot of the finish where the repair is to be made with a lacquer thinner dampened rag 2. If the finish softens, it is lacquer 3. If it does not, it is enamel

TASK: Mask Off Adjoining Panels

JOB: Prepare Surface for Complete Panel Refinishing

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: 3/4" masking tape, 18" masking paper, clean rags

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Outline Adjoining Panels	1. Blow any dust off of adjoining panels with blow gun 2. Wipe off repaired panel and edges of adjoining panels with clean dry rag 3. Apply 3/4" masking tape along edges of adjoining panels a. Use one strip b. Press down firmly
2. Apply Masking Paper	1. Use paper/tape dispenser 2. Pull off paper/tape in easily handled lengths 3. Apply taped edge of paper along previously taped edges of adjoining panels 4. Press down firmly to seal 5. Allow untaped portion of paper to cover protected panels 6. Continue until the areas surrounding the repair panel are completely protected a. Use 18" masking paper b. Use two strips of paper if necessary 7. Seal all the joining edges of the paper with tape 8. Tape down the loose edges of the paper a. Prevents paper from flapping or blowing over onto the painted surface b. Use short strips 2" long c. Space about 18" apart
3. Mask Off Chrome Moldings	1. Use blow gun to blow dust and any trapped moisture out from under moldings Note: If practical, all moldings, emblems, and nameplates on the repair panel should be removed before refinishing 2. Apply 3/4" tape along top edge of molding a. Do not allow tape to touch the painted surface

STEPS	KEY POINTS
	b. Apply slow and carefully c. Press down firmly to seal
	3. One continuous strip along entire length of molding
	4. Peel tape off roll as masking progresses Note: For narrow moldings, sharp curves, or medallions and nameplates, it would be easier to use narrow tape, such as 1/8" or 1/4"
	5. If molding is not completely covered by one strip, apply second strip of tape along the bottom edge of molding

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TASK: Finish Sand Panel

JOB: Prepare Surface for Complete Panel Refinishing

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Rubber sanding block, 240 and 400 grit wet or dry sandpaper, water source, clean rags, air source, blow gun

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Load Sanding Block	1. Use 6 - inch rubber block 2. Use 240 grit wet or dry paper a. Fold sheet of paper in half lengthwise b. Crease the fold c. Open sheet back up and tear into two pieces at the crease d. Fold one of these pieces in half again lengthwise e. Fold with grit side out 3. Insert folded sandpaper into sanding block a. Secure one end into block b. Fold sandpaper around block tightly c. Cutting side of paper on flat side of block d. Secure other end
2. Sand the Panel	1. Apply water to the panel a. Use bucket and sponge b. Use water hose with low pressure Note: Use water sparingly to avoid damaging the masking paper. Only enough to flush off the sanding residue 2. Keep sanding block flat to surface 3. Use straight even strokes 4. Use light hand pressure on block 5. Block sand entire panel a. Use horizontal strokes b. Use vertical strokes Note: Sand carefully around creases for sharp edges to avoid sanding completely through paint film
3. Inspect Sanded Area	1. Wipe off water with clean rags 2. Use blow gun to finish drying panel 3. Inspect surface

STEPS	KEY POINTS
	a. For scratches b. For chips in old finish c. For shiny or unsanded areas 4. Repeat sanding operation if necessary
4. Finish Sanding	1. Fold sheet of 400 grit sandpaper in half lengthwise and crease 2. Tear sheet into two pieces at the crease 3. Fold one of these pieces twice a. Fold with grit side out b. Makes a pad one - third its original length 4. Hold folded sandpaper with its length running along fingers and into the palm of one hand Note: Tuck one corner of the paper up between the little finger and the ring finger to make holding easier 5. Apply water to surface 6. Sand complete panel using straight even strokes a. Use light pressure of hand b. Sand with flat of hand, not the fingertips 7. Turn sandpaper over or unfold as necessary to expose new cutting surface as needed 8. Repeat inspection process and resand if necessary

TASK: Final Preparations

JOB: Prepare Surface for Complete Panel Refinishing

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Air source, blow gun, clean dry rags, 3/4" masking tape, sponge, tac rag

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Dry Vehicle	1. Wipe water from sanded surface a. Use clean dry rags b. Use sponge 2. Wipe excess water from masking paper Note: Use a blotting action to avoid tearing paper 3. Use blow gun to finish drying sanded surface 4. Blow water out from under any moldings Caution: Use low air pressure and blow carefully to avoid tearing the masking paper 5. Blow water from any creases, body joints, or cracks arounded the sanded area 6. Dust off entire vehicle with blow gun 7. Wipe off entire sanded panel with tac rag a. Use very light pressure on tac rag b. Unfold tac rag often to expose a fresh sticky side
2. Inspect Masking	1. Check for any remaining moisture or dust on masking paper 2. Check for any rips or tears in paper a. Seal tear with one or more strips of masking tape b. Replace paper strip if necessary 3. Inspect masking tape on moldings or chrome and reseal or replace if necessary 4. Make sure edges of masking tape on all panels surrounding the sanded area are sealed tightly

INSTRUCTOR'S PLAN VII-A-3(S)
MANIPULATIVE LESSON

TASK:	Prepare Surface for Overall Refinish of Topcoat
AIM:	The student will be able to prepare a vehicle for a complete overall refinishing of the topcoat using the correct procedures and techniques
TOOLS AND EQUIPMENT:	Air source, water source, spray gun, rubber sanding block, blow gun, small brush, water bucket
MATERIALS:	Sandpaper (80D, 240, 360, and 400 grits), primer - surfacer, lacquer thinner, paddles, clean white rags, cleaning solvent, soap, tac rag, 3/4" masking tape, masking paper
TEACHING AIDS:	
REFERENCES:	Auto Body Repairing and Repainting, pp. 159-202 Refinisher's Guide, pp. 7-33
PREREQUISITE EXPERIENCE OF THE LEARNER:	The student must be thoroughly familiar with the various tasks involved in Preparing a Surface for Refinishing, (VII-A-2(S)) and must have passed the verification stage of VII-A-1(I), "Preparations for Painting"
CHECKING STANDARDS:	1. Selection of proper materials 2. Following procedures and tasks as outlined 3. Knowledge of previous lessons

I. PREPARATION (OF THE LEARNER - MOTIVATION)

In cases where several panels on a vehicle have been repaired, it might be more practical to refinish the entire vehicle. The original finish may have been deteriorated by weather, or the owner might want to change to a different color. For whatever reason, there will be occasions when a complete vehicle must be refinished. A properly prepared surface is necessary in order for an applied finish to look good upon completion and to last for a respectable length of time.

This lesson will outline the various tasks and procedures that must be followed to insure a satisfactory job.

II. PRESENTATION (OF THE SKILLS

STEPS	KEY POINTS (THINGS TO REMEMBER TO DO OR SAY)
1. Determine Condition of Old Finish	1. Inspect condition of surface for: a. Peeling b. Cracking c. Chips or scratches d. Repaired areas

Note: If any of these conditions exist, it must be repaired using techniques learned in previous lesson (VII-A-1(S))

2. Determine type of paint used in old finish
   a. Lacquer
   b. Enamel

2. Order Needed Materials

1. Locate paint code number on vehicle identification plate
2. Locate corresponding color code number in color chip book
   a. By make of vehicle
   b. By year and model
   c. Double check by comparing color chip with color of car
3. Order amount and color of paint needed
4. Order correct solvents needed
   a. For type of paint used
   b. For temperature and shop conditions
   c. Cleaning solvent

3. Clean Vehicle

1. Move vehicle to wash area
2. Clean vehicle with cleaning solvent
   a. Use solvent - wetted clean rag
   b. Rub small areas at one time
   c. Wipe spot immediately with clean dry rag
   d. Scrub entire surface of vehicle in this manner
3. Wash vehicle thoroughly with soap and water
   a. Start at top and work down
   b. Scrub with wash brush or rags
   c. Wash all chrome and tires and wheels
   d. Rinse thoroughly with clean water

4. Sand Vehicle

1. Remove all chrome moldings, emblems, or nameplates that are easily removed
2. Remove bumpers if necessary
3. Thoroughly sand entire vehicle
   a. Start at top and work down
   b. If new topcoat will be enamel use 360 grit sandpaper
   c. If new topcoat will be lacquer sand with 400 grit sandpaper
   d. Fold sandpaper up small and sand as close to moldings, door handles, glass,

	etc., as possible e. Use plenty of water during the sanding operation Note: Avoid sanding with the fingertips. Use the flat of your hand f. Change sandpaper in block as often as necessary when the grit becomes worn down 4. Rinse vehicle thoroughly with clean water
5. Mask Vehicle	1. Move vehicle to painting area 2. Wipe off excess water with clean dry rags 3. Finish drying vehicle with blow gun a. Blow water out from underneath moldings b. Blow out all joints and body seams c. Blow moisture from around all glass areas 4. Wipe down entire vehicle with clean dry rags 5. Mask off all chrome moldings a. Use 3/4" masking tape b. One or more strips as needed c. Press on firmly 6. Mask off all glass areas a. Windshields, door glasses, etc. b. Use tape/paper dispenser c. Seal all joints in the masking paper with tape 7. Mask all other non - painted areas a. Grille b. Head and tail lights c. Bumpers d. Radio antennas e. Outside mirrors 8. Mask all 4 wheels with wheel covers
6. Make Final Preparations	1. Make final check of sanding and masking 2. Blow off entire surface with low pressure and blow gun 3. Wipe down all sanded surfaces with tac rag
7. Clean Up	1. Return all tools and unused materials to storage area 2. Sweep up work stall or paint booth 3. Put all trash, paper, and dirty rags in metal trash container

4. Use squeegie to push water into floor drain

III. APPLICATION (PRACTICE BY LEARNER UNDER CLOSE SUPERVISION)

1. Each student work group to prepare a vehicle for overall refinishing.
2. Observe progress and correct any mistakes in techniques or procedures.
3. Have students recite key points as they perform each task.
4. Observe each work group and make sure all students are participating in the job.

IV. VERIFICATION AND/OR EVALUATION (CHECK ON STUDENT'S ABILITY)

1. Have students repeat the tasks in the order that they should be performed.
2. Ask each student to name a key point of each task.
3. Have each work group inspect the quality of the other group's work.

V. SUMMARY (TELL THE STEPS ON PROCEDURE AS TO WHAT, HOW, AND WHY. REVIEW CHECKING STANDARDS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENTS.)

1. Careful, thorough preparation is essential.
2. Each task must be performed in the exact manner outlined.
3. Any step omitted, or any task performed poorly, affects the quality of the finished topcoat.
4. Repeat each step as often as necessary for completion of task.

SUGGESTED READING FOR THE STUDENT:

Auto Body Repairing and Repainting, pp. 159-202
Refinisher's Guide, pp. 7-33

The Next Lesson Is: VII-B-1(I) "Painting with Spray Gun"

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JOB:	Prepare Surface for Overall Refinish of Topcoat
MATERIALS:	Sandpaper (80D, 240, 360, and 400 grits) primer - surfacer, lacquer thinner, clean rags, paddles, cleaning solvent, soap, water, tac rag, 3/4" masking tape, masking paper
TOOLS AND EQUIPMENT:	Air source, water source, spray gun, blow gun, rubber sanding block, small brush, water bucket
GENERAL INSTRUCTIONS:	This job is similar to preparing the surface for panel refinishing. The main difference is in the cleaning and masking operations. Follow the steps in each task carefully.

PROCEDURES AND/OR TASKS:		
	VII-A-2a(TS)	Determine Condition of Finish
	VII-A-1a(TS)	Initial Preparation
	VII-A-3a(TS)	Clean Vehicle
	VII-A-3b(TS)	Water Sand Painted Surfaces
	VII-A-3c(TS)	Mask Vehicle
	VII-A-1g(TS)	Clean Up

TASK: Clean Vehicle

JOB: Prepare Surface for Overall Refinish of Topcoat

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Clean white rags, cleaning solvent, soap and water, air source, blow gun, small brush, bucket

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Clean Vehicle with Solvent	1. Move vehicle to wash area a. Well ventilated b. Floor drain c. Water source 2. Use blow gun to blow off surface dust and dirt 3. Fold clean white rag into a hand - size pad 4. Wet pad with solvent a. Use correct cleaning solvent b. Wet pad thoroughly but not dripping wet Note: Lacquer thinner or reducing solvents should never be used for this purpose. Use only approved cleaning solvent 5. Rub into old finish a. Rub with a scrubbing or scouring motion b. Use medium to heavy pressure on pad c. Scrub an area approximately 2 feet square 6. Wipe off the scrubbed area immediately with clean dry rag 7. Continue this operation until entire painted surface has been scrubbed a. Start at top and work down b. Give particular attention to body joints, seams, cracks, and up next to moldings Note: The use of a small brush (such as an old toothbrush) will make cleaning these areas easier
2. Wash Vehicle with Soap and Water	1. Put one cup of soap or strong detergent in water bucket 2. Fill bucket with water and agitate to mix

STEPS	KEY POINTS
	3. Start at top of vehicle 4. Scrub and wash thoroughly a. Use a stiff wash brush b. Use clean rags or rough sponge 5. Use medium pressure on brush or rag to work up good lather 6. Dip brush or rag into bucket often and apply plenty of soap 7. Flush surface often with clean water 8. Continue scrubbing operation until complete vehicle has been cleaned a. All painted surfaces b. Vinyl top c. All glass area d. All chrome parts e. Tires and wheels

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TASK: Water Sand Painted Surfaces

JOB: Prepare Surface for Overall Refinish of Topcoat

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Water source, 360 or 400 grit sandpaper, sanding block

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Prepare Vehicle	1. Remove moldings, emblems, or name plates a. Pop - on or friction clip (1) Insert tip of flat screwdriver blade between molding and sheet metal surface (2) Use a twisting motion of the screwdriver handle to separate molding from clip (3) Use light pressure to avoid damaging clip b. Nut - type or T - bolt clip Note: Due to the design of some vehicles, the nuts on some of this type of clip may not be easily accessible. In this case, do not attempt to remove the molding (1) Determine size of attaching nut (2) Obtain necessary size wrench, or ratchet and socket (3) Turn nuts to left to remove (4) Store nuts in safe place for reuse later c. Glue - on type (1) Start at end of molding (2) Insert end of flat putty knife or scraper blade between molding and sheet metal surface (3) Push blade forward underneath molding to separate (4) Work carefully to avoid scratching surface or damaging molding 2. Store all removed parts in a safe place for re-installing later 3. Remove bumpers

STEPS	KEY POINTS
	Note: This is necessary only when changing colors on a vehicle or if the area behind the bumper is inaccessible for sanding and painting a. Unplug wires for parking or directional lights if they are mounted in bumper b. Locate and remove attaching bolts Caution: Some bumpers are fairly heavy. Use assistance of helper to remove
2. Load the Sanding Block	1. Use 6-inch rubber block 2. Select sandpaper a. 360 grit if topcoat will be enamel b. 400 grit if topcoat will be lacquer 3. Fold sandpaper in half lengthwise and crease 4. Open sheet back up and tear into 2 pieces at the crease 5. Fold one of these pieces in half again lengthwise 6. Fold with grit side out 7. Insert folded paper into sanding block a. Secure one end in block b. Wrap sandpaper around flat side of block c. Pull paper tight d. Secure other end into block
3. Sand the Vehicle	1. Start at top and work down 2. Apply water to painted surface a. Use bucket and sponge b. Use water hose with low pressure 3. Use straight even strokes with sanding block 4. Keep block flat to surface 5. Use light pressure on block Note: Use care when sanding creases or sharp curves to avoid sanding completely through the paint film 6. Sand entire top in this manner 7. Use plenty of water to flush off the sanding residue 8. Continue sanding operation around rest of vehicle 9. Change sandpaper in block as often as necessary when grit becomes worn down

STEPS	KEY POINTS
	Note: In some areas, such as a high crown surface or close around glasses, drip rails, or moldings, it will be better to use the sandpaper without the sanding block

TASK: Mask Vehicle

JOB: Prepare Surface for Overall Refinish of Top Coat

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: 3/4" masking tape, masking paper, clean dry rags, tac rag

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Dry Surface	1. Move vehicle into paint booth or painting area 2. Turn on exhaust fans 3. Wipe off excess water with clean dry rags a. Start at top and work down b. Wring water out of rags often c. Wipe complete vehicle 4. Use blow gun and air to finish drying sanded surface 5. Blow water out from underneath moldings a. Use 45-65 psi air pressure b. Apply nozzle of blow gun to crack where molding meets sheet metal surface c. Blow along entire length of molding d. Blow top side and bottom side e. As water comes out, wipe it dry with clean dry rag 6. Blow out all joints and body seams a. Use same procedures as with moldings b. Blow from several different angles c. Wipe with clean dry rag 7. Use same procedures to dry all glass areas a. Windshields b. Side glasses c. Back glasses d. Outside mirrors
2. Mask Off Chrome Moldings	1. Wipe off all moldings with clean dry rag 2. Use 3/4" masking tape Note: Narrow moldings or sharp curves are more easily masked with 1/4" tape 3. Start at end of molding

STEPS	KEY POINTS
	4. Apply tape to top of moldings a. Edge of tape on extreme edge of molding b. Tape should not touch the painted surface 5. Press down firmly to seal 6. Run tape along entire length of molding 7. Unwind tape from roll as work progresses 8. On moldings wider than one strip of tape, a second strip must be applied a. Apply to bottom edge of molding b. Tape must not touch painted surface c. Overlaps first strip d. Press down firmly to seal 9. Mask off all moldings in this manner
3. Mask Off Glasses	1. Outline edges of glass area with tape a. Use 3/4" tape b. Use one strip c. Press down firmly to stick d. Tape should not touch painted surface 2. Apply masking paper a. Use paper/tape dispenser b. Pull off taped paper in easily handled lengths c. Apply taped edge of paper along outline tape d. Overlap half the width of tape e. Press down firmly to stick 3. Untaped portion of paper covers glass 4. Edge of paper may be folded back as necessary to follow contour of glass 5. Seal all joints in masking paper with masking tape Note: Some wider glasses, such as windshields, may take more than one strip of paper. Wider paper, up to 36 inch, may also be used 6. Cover all glasses in this manner
4. Finish Masking	1. Mask off all other non-painted areas a. Grilles b. Vinyl tops c. Lights d. Bumpers

STEPS	KEY POINTS
	e. Radio antennas f. Outside mirrors 2. Use same procedure as above a. One or more strips of tape b. Tape and paper combination on wider areas 3. Mask off tires and wheels a. Use drop cloth b. Use prepared wheel covers

INSTRUCTOR'S PLAN VII-B-1(I)
INFORMATIONAL LESSON

SUBJECT: Painting with Spray Gun

AIM: The student will be able to identify the processes involved in mixing and applying paint using the suction feed type spray gun

TEACHING AIDS: Transparencies AB VII-B, Figs. 9-16

MATERIALS: Paint, paint thinning solvent, paint strainer, paint stirring paddle, suction type paint gun, rubbing compound, clean rags, dusting gun, tac rag, respirator mask

REFERENCES: Automotive Refinishing Principles and Techniques, pp. 70-90
Refinisher's Guide, pp. 21-39
Auto Body Repairing and Repainting, pp. 173-202
Information Sheets VII-B-1(ISa, b)

PREREQUISITE EXPERIENCE OF THE LEARNER: The student must have successfully completed the lessons on surface preparation and studied information sheets VII-B-1(ISa) and VII-B-1(ISb)

I. PREPARATION (OF THE LEARNER - MOTIVATION)

Despite the amount of knowledge painters may have concerning the job, until they become expert with the paint spray gun they cannot do professional work. Although the topcoat on an automobile is thinner than a sheet of writing paper, it is durable, appealing, and has helped to make the automobile the glamorous machine it is today. It takes many hours of practice to become a professional spray painter. However, by learning and understanding the technical information about spray painting, this learning time can be shortened. This lesson is about the process of applying a top coat, and the test will be over the identification of procedures and the major terms in the lesson

II. PRESENTATION (OF THE INFORMATION)

INSTRUCTIONAL TOPICS TEACHING POINTS	THINGS FOR STUDENTS TO DO THINGS FOR INSTRUCTOR TO DO OR SAY
1. Final masking	1. Is done after the vehicle has been moved to a ventilated painting area 2. Mask any surface that is subject to over-spray 3. Mask any portion of vehicle that is not to be painted
2. Cleaning a. Spot refinish Show Transparency: Fig. 9	1. The surrounding area of a spot repair must be cleaned to provide a true, clean color 2. Clean area with rubbing compound and a

clean rag

b. Panel and overall refinish
Show Transparency: Fig. 10
1. Wipe down with solvent
2. Wipe down with clean, dry rag

3. Dusting
1. Blow off surface to remove dust
   a. Use dusting gun or blower nozzle
   b. Use paint gun
2. Blow around panel cracks and moldings
3. Blow off all masked areas
4. Wipe entire surface with tac rag

4. Select paint gun
   a. Pressure feed
1. Used mostly on overall refinishing of large vehicles
2. Used in a variety of custom painting applications
3. Fluid pot size may vary from 1 quart to 5 gallons
4. Gun position has no effect on fluid supply

Show Transparency: Fig. 11

b. Siphon feed
1. Used for most automotive refinishing
2. More practical for spot refinishing
   a. Wastes less paint
   b. Easier, faster clean up

Show Transparency: Figs. 12

Note: In either type spray gun the main parts of the gun are the same, and the air/fluid flow patterns are identical

5. Mix paint
Show Transparency: Fig. 8
1. Stir paint thoroughly to mix binder, pigment, and solvent
2. The appropriate thinning solvent is added
   a. Use paint manufacturer's recommendations as to paint solvent thinning ratio
   b. Use a solvent suitable for shop conditions and temperature
3. Add any special additives
   a. Fish eye preventer
   b. Retarder
4. Paint is restirred
5. Pour paint through strainer into the paint gun cup
   a. Removes any trash and debris
   b. Removes any unmixed paint solids

Caution: Always wear respirator mask when painting

6. Painting
1. Adjust air pressure for type of paint being used

Show: Transparency: Fig. 13

2. Test and adjust spray pattern
   a. On paper taped to wall
   b. On masked area of vehicle
3. Hold gun at the appropriate distance and correct angle

Show: Transparency Fig. 14

   a. Approximately one hand span
   b. At right angle to surface
4. Spray one coat over entire surface
   a. Alternate right and left strokes
   b. Trigger gun at beginning and end of strokes
   c. Overlap one-half the previous stroke for smooth coverage

Show: Transparency Fig. 15

   d. Avoid arcing the gun
   e. Move gun at steady, even speed

Show Transparency: Fig. 16

5. Spray successive coats as needed for type paint being applied

   Note: On spot repair painting it is necessary to use a blend or mist coat, as final coat

7. Inspection
   1. Check for full coverage of surface
   2. Check for smooth, even topcoat film

8. Clean up
   1. Discard or return paint to container depending on additives used
   2. Clean gun thoroughly with cleaning solvent or painting area or paint thinner
   3. Clean up painting area or paint booth

      Caution: Store all solvent-dampened rags or paper in covered metal container
   4. Return all tools and materials to storage area

III. APPLICATION (DRILL, ILLUSTRATIONS, ANALOGIES, ORAL QUESTIONS OR ASSIGNMENTS, MAKING INVESTIGATIONS OR EXPERIMENTS, NOTE TAKING, MAKING SKETCHES, PARTICIPATING IN DISCUSSION).

1. Have student repeat the process of painting with a spray gun. Make sure student identifies each step involved in the process
2. Have other students identify the key points that accompany the steps
3. Have students visit an auto body repair shop and observe workers spray painting

IV. VERIFICATION AND/OR EVALUATION (FINAL CHECK ON STUDENTS' COMPREHENSION OF MATERIALS PRESENTED).

Have each student list the eight steps in the process of spray painting and list the key points that accompany those steps (as listed in stage II)

V. SUMMARY (GIVE A BRIEF ACCOUNT OF EACH TOPIC REEMPHASIZING THE IMPORTANT POINTS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENT).

1. The eight steps in spray painting are:
   a. Final masking
   b. Cleaning
   c. Dusting
   d. Select paint gun
   e. Mix paint
   f. Apply paint
   g. Inspection
   h. Clean up
2. Each step must be carried out thoroughly in order for the paint topcoat to be applied properly and to have the proper luster, shine, and durability

SUGGESTED READING FOR THE STUDENTS:

Automotive Refinishing Principles and Techniques, pp. 70-90
Refinisher's Guide, pp. 21-39

The Next Lesson Is: VII-B-1(S) "Make Spot Repair Topcoat Application (Acrylic Lacquer)"

INFORMATION SHEET
ON
REFINISHING

VII-B-1a(IS)

SUBJECT: Spray Painting Equipment

INTRODUCTORY INFORMATION:

The equipment involved in the spray painting operation must be considered from both the technical and practical aspects. It is not a conglomeration of items, but rather a carefully selected and coordinated group whose sole purpose is to do the best job possible.

GENERAL INFORMATION:

Spray guns are used to such an extent in today's industry that it might be said that we live in a spray - painted world. Regardless of its size or design, almost any item that has an applied finish was painted with a spray gun. The speed and ease of operation has made the spray painting process a particular favorite of the automotive industry.

Unfortunately, there is a shortage of competent, trained painters with a complete knowledge of the process. Modern refinishing techniques require the very best equipment if a quality finish is to be obtained. Many painters fail to realize that this equipment is manufactured with a great deal of care and designed to do specific jobs. Operating procedures, techniques, care, and cleaning are essential in achieving trouble - free operation.

There are three basic units in a modern, spray-painting system; the air compressor, the air transformer (or regulator), and the spray gun.

The Air Compressor

A good air compressor is the lifeline of the automotive refinishing industry. It is designed to supply air continuously at a predetermined pressure and a minimum volume, usually measured in cubic feet per minute. The size of a compressor can vary according to needs. There are usually two factors to consider when determining compressor size: the amount of air the compressor is capable of delivering at the required working (line) pressure, and how much air will be required to run the air powered tools in the shop. A first quality compressor will usually deliver approximately four cubic feet per minute per horsepower. Its maximum output can be determined by multiplying these two factors. Continuous operation of the compressor at its maximum level of output, however, is highly impractical. This would result in literally working the compressor to death. The compressor's maximum capacity should always be at least 15% higher than the maximum volume of air that would normally be needed.

There are two general types of compressors, the single-stage and the two-stage. The main difference between the two is the method of compression. The single stage inducts outside air and compresses it in one stage to final tank pressure. This type is usually used where a 100 psi maximum or less is desired.

As a rule this type compressor is only 60% efficient and is not well suited for industrial use. The two stage compressor has two cylinders of a different size. Outside air is inducted by the larger cylinder and compressed to an intermediate pressure. It is then passed to the smaller cylinder where it is compressed to final tank pressure.

This type of compressor is 80% efficient and is best suited for industrial use where continuous use of high pressure is necessary.

Either compressor may be a horizontal or vertical (upright) model and is usually driven by an electric motor. Gasoline powered compressors are available but are not practical for shop use. All compressors are equipped with a pre-set pressure limit switch and a pressure relief or pop-off valve for safety's sake. A valve is provided for draining condensation from the air storage tank.

The Air Transformer (or Regulator)

The air transformer is a device which removes moisture and foreign materials such as oil or rust particles from the air system. It also regulates the pressure of the air being used by tools and spray guns. Incoming air from the compressor is filtered by mechanical means and air expansion, allowing only clean dry air to reach the spray gun. It is important that this unit be drained daily.

The workings of a typical transformer are relatively simple. The compressed air enters the transformer through the main pressure line and enters the regulator chamber. A regulator knob is adjusted until the desired pressure is reached. This opens a diaphragm and allows that much air to pass through a series of water separators and baffles which cleans the air of its impurities. It is then passed out the regulated air valves to the spray gun.

A top quality transformer will be equipped with two gauges. One gauge indicates the unregulated, or main tank line pressure, while the other indicates the regulated pressure. One or more outlet valves are usually provided on both the line pressure side and the regulated pressure side. A drain valve, usually located at the bottom of the transformer, is provided for emptying the trapped moisture. For best filtering results, the transformer should be mounted in the main pressure line at least 25 feet from the compressor.

The Spray Gun

The spray gun is simply a mechanical means of bringing air and paint together.

Its primary function is to atomize or break up the paint stream into a controlled spray and, by air pressure ejection, apply it to a surface. A spray gun is a precision instrument and any gun suitable for quality work will be easily adaptable for spraying any type of material. It is important to use a gun that has been specifically designed for the job at hand.

A wide choice of spray guns is available, and one should be selected depending on the intended use. The painter should choose a production - type gun regardless of whether it will be used on a suction cup or with pressure feed equipment.

Smaller guns are available, but their use should be limited to spot painting or touch-up.

The manner in which paint is supplied to the gun determines if it is a suction-feed or pressure-feed type. Either of these types may be further divided into bleeder and non-bleeder, external or internal mix guns.

Suction Feed

This type has the paint container or cup fastened directly to the gun by means of a fluid pick up tube. A vacuum is created in this tube when the trigger is pulled allowing air to flow out of the orifice surrounding the fluid tip. The pain is sucked up through this tube and out through the fluid nozzle where it is atomized by air pressure.

The paint container or cup on a suction - feed gun is usually limited in size to one quart. Larger cups are available but are not practical due to their filled weight. The cup cover is provided with a vent hole to allow air to enter the cup and replace the paint as it is used. This hole must be kept open for proper operation. For this reason a suction - feed gun should always be held and used in a vertical, upright position.

Pressure Feed

In this type the paint is placed in a closed container which is then pressurized with air. This container or pot is connected to the gun by a fluid hose. The paint is thus forced up through this hose and to the fluid nozzle by air pressure.

This type is usually used where large quantities of the same color of paint are used. The container or pot may be any size ranging from 2 quarts to 60 gallons, and is usually equipped with its own regulator and gauge for adjusting pressures. Since the paint is in a separate closed container and supplied to the gun through a flexible hose, this type of gun may be used in any position, even upside down.

Bleeder Type

This type of gun has a continuous discharge of air from the air cap, even after the trigger is released. This prevents pressure buildup in the gun or hose. It is most often used where there is no pressure control regulator in the system. It is best suited for use with a small diaphragm - type compressor such as might be used around the home. It is not well suited for industry use.

Non-Bleeder Type

This is the type most often used in an auto body repair shop. It is equipped with an air valve that shuts off the air as well as the fluid when the trigger is released. Since it is used in a system that has regulated air pressure there is no danger of pressure buildup in the gun or hose.

External Mix - Internal Mix

The shape of the air cap determines whether a gun is classified as external or internal mix. Just as the name implies, an external mix gun mixes air into the paint after it has left the gun, approximately 1/2 inch in front of the air cap. This is the type most often used in automotive refinishing, due to its versatility. An internal mix gun mixes the fluid / air inside the air cap. For this reason it is limited to spraying materials with extremely slow drying times and is not well suited for use in an auto body refinishing shop.

Of the various designs and types of guns mentioned, an ideal spray gun for automotive refinishing would be a suction - feed, non-bleeder, external mix, production type, with a one-quart paint cup. There are three major manufacturers of spray guns. All are top quality products and with reasonable care will furnish years of trouble - free operation.

INFORMATION SHEET
ON
REFINISHING

VII-B-1b(IS)

SUBJECT: Spray Painting

INTRODUCTORY
INFORMATION

The spray gun is the most important item in the spray painting process. Until the painter learns its inner workings and becomes proficient in the techniques involved in its use, professional results cannot be obtained. It takes many hours of practice to become a professional spray painter. By learning and understanding the technical information about spray painting, however, this apprentice time can be reduced.

GENERAL INFORMATION

The paint spray gun works by turning liquid into tiny droplets by means of forced air pressure. This process is called atomizing.

A typical paint gun is composed of eight major parts: The air nozzle or cap, the fluid nozzle or tip, fluid needle, trigger, fluid control valve, the handle or body, air valve, and the pattern control or spreader valve. Each of these major parts functions in either pulling, pushing, or directing the fluid into the air stream to be atomized.

The Air Nozzle or Cap: The air cap is located at the very front of the gun. It may be external or internal mix, with the external mix type being the one most often used. It has three primary functions:

1. It directs air across the fluid tip to create a vacuum and suck fluid from the paint cup.
2. Directs the air into the fluid stream to atomize the paint, and
3. By directing some of the air through the air horn orifices it alters the spray shape or pattern width. The size of the air cap is determined by the type of paint being sprayed. Some are made with 5, 7, 9 or more orifices. These offer better atomization for the more viscous materials, such as enamels and thick primers.

The Fluid Nozzle or Tip: The fluid nozzle is a precision machined part that directs the paint into the air stream. It also serves as a seat for the air cap and helps equalize the air leaving the center orifice of the cap. It is available in several sizes, depending on the type of paint being sprayed. The fluid nozzle and fluid needle are always used in a matched set; that is they should have the same numbers - FF nozzle - FF needle, EX nozzle - EX needle. The two matched parts also act as a valve in that they can allow the paint to leave the gun or cut it off completely.

Fluid Needle: The fluid needle controls the amount of paint that flows through the fluid nozzle tip. This is accomplished by varying the distance of the needle end

from its seat in the fluid nozzle. For this reason the needle must always be used in a matched set with the fluid nozzle. The action of the fluid needle is controlled by the trigger.

Trigger: The trigger has two functions. As it is pulled back, it has two "stops". The first stop is about half way back. When the trigger is pulled to this position, it allows only air to pass from the gun. When pulled all the way back, it pulls the fluid needle out of its seat, allowing paint to flow out of the tip of the fluid nozzle. The distance the trigger can pull the needle back may be adjusted by the fluid control valve.

Fluid Control Valve: This is the bottom adjustment knob on the paint gun and it changes the distance the fluid needle may be pulled back. It adjusts or presets the needle so it will release the desired amount of fluid into the air stream when the trigger is pulled all the way back. By turning the knob in (to the right) the trigger travel is shortened, thus reducing the amount of fluid being sprayed. Turning out (to the left) increases the fluid output. This action in no way affects the air valve, which will still at all times open first and close last in relation to the fluid flow.

Air Valve: This is the main air control valve in the paint gun. It is opened when the trigger is pulled back to its first stop. This allows the air to flow before the fluid nozzle is opened and after the fluid nozzle is closed. This insures atomization of every drop of paint leaving the spray gun.

Pattern Control Valve: This is the top adjusting knob on the spray gun. Turning this valve in or out changes the width and shape of the spray pattern. When the valve is turned all the way in (closed) all the air is flowing through the center orifice of the air cap. This results in a small round pattern. As the valve is turned out (opened) it allows an increasing amount of air to flow through the air horn orifices of the air cap. This air blows across the fluid stream as it leaves the center orifice and spreads the fluid into a wider pattern.

Handle: This is simply a pistol - shaped housing that holds all the aforementioned parts. It has several passages that allow fluid and air to flow to the various valves and nozzles that regulate the fluid/air mixture. It is designed for comfortable, convenient operation with one hand.

To become a true professional, the painter must learn the function of each part of the gun and what effect each has on the total painting operation.

Handling the spray gun looks very simple when watching an experienced painter. As with most skills, however, success is the end results of many hours of patient practice.

To be successful when using a spray gun, two basic facts must be kept in mind:

First, the air and fluid controls must be adjusted properly, and second, the gun must be held and moved correctly.

Before any adjustments are made on the gun itself, the air pressure coming to the gun should be adjusted at the regulator. Usually, the air pressure recommended for the paint being sprayed will be listed on the paint can label. If no recommendations are given, however, the following "rule of thumb" recommendations may be used:

Lacquers sprayed at 30 - 45 psi
Acrylic enamels sprayed at 45 - 70 psi
Alkyd or urethane enamels sprayed at 45 - 60 psi

These are only general guidelines, however, and more or less pressure may be used if better results are seen under given shop and temperature conditions.

There are two adjustments that must be made to the gun; the fluid output and the shape and size of the spray pattern. The pattern control valve should be adjusted to produce a spray pattern approximately 6" long when the gun is held the proper distance from the surface. This pattern may be changed from vertical to horizontal, if necessary, by rotating the air cap 90°. The fluid control valve should be adjusted to produce a full, medium wet pattern, with good coverage and no runs or sags. These adjustments will vary slightly when spraying different materials. A test pattern should be sprayed on a piece of masking paper or cardboard taped to the wall, and further adjustments made if necessary. This should always be done before beginning any spraying task.

Correct manipulation of the gun is essential for good painting results. There are several factors that must be considered. The gun should be held at the proper distance for the material being sprayed, approximately 6 - 8 inches for lacquers and 8 - 10 inches for most enamels. Moving the gun in closer may result in runs or sags, and moving it too far away will cause a dry, dull pattern. The proper angle is important also. The gun should always be held at right angles to the surface being sprayed. Failure to do this results in an uneven pattern, with more or less material being applied where the pattern is closer to or farther away from the surface. The gun should be moved at a speed slow enough to get good coverage but fast enough to prevent too much material from being applied in one spot. Usually, about one foot per second will be sufficient. Do not stop the gun in the middle of a spraying pass or the sprayed material will drip and run. Move the gun with steady, deliberate strokes. Release the trigger at the end of each stroke and pull it again as you begin the next stroke. Make each succeeding stroke from the opposite direction. Overlap the patterns approximately one-half their widths as each spraying pass is made. These procedures may be varied as necessary for the materials being sprayed.

True skill in the use of the spray gun comes more quickly to some than to others, but, in the final analysis, only repeated practice will produce a professional painter.

INSTRUCTOR'S PLAN VII-B-1(S)
MANIPULATIVE LESSON

TASK:	Make Spot Repair Topcoat Application (Acrylic Lacquer)
AIM:	The student will be able to make the topcoat application of a spot repair area using a syphon type spray gun.
TOOLS AND EQUIPMENT:	Compressed air, air hose, suction type paint gun, mixing paddle, strainers
MATERIALS:	Acrylic lacquer paint, lacquer thinner, clean shop towels
TEACHING AIDS:	
REFERENCES:	Auto Body Repairing and Repainting, pp. 173-202 Collision Repair Guide, pp. 205-225 The Principles of Auto Body Repairing and Repainting, pp. 361-454 Automotive Collision Work, 333-365 Automotive Refinishing Principles and Techniques, pp. 65-90 Refinisher's Guide, pp. 21-22, 23, 35-41 A Guide to Better Automotive Refinishing, pp. 21-23
PREREQUISITE EXPERIENCE OF THE LEARNER:	The learner must have prepared the surface following the procedures in lesson VII-A-1(S), "Prepare Surface for Refinishing Spot Repair"
CHECKING STANDARDS:	1. Selection of materials. 2. Proper preparation and application of topcoat. 3. Appearance of topcoat after application. 4. Proper use of tools and equipment.

I. PREPARATION (OF THE LEARNER - MOTIVATION)

It is not possible to give detailed instructions for spot repair refinishing that would be applicable to all jobs. There are basic steps, however, and those steps are outlined in this lesson.

The test will be on the student's ability to properly apply a topcoat to a spot repair job.

II. PRESENTATION (OF THE SKILLS)

STEPS	KEY POINTS (THINGS TO REMEMBER TO DO OR SAY)
1. Preparation	1. Remove tape and paper from around the repair panel 2. Water has probably accumulated under the mouldings and must be removed

3. Place vehicle in painting area

2. Dust Surface
   1. Dust surface and cracks with dusting gun
   2. Remove all water, sanding residue, and dirt
   3. Make final inspection of surface for small sandscratches that need to be removed

3. Final Masking
   1. Retape and paper surrounding panel
      a. Place paper and tape as close to the repair panel as possible without touching it
      b. Depending on how far the repair is from the adjacent panel, use one or two widths of paper
   2. Tape outside edges of paper down to keep them from getting in the repair

4. Tack Wipe
   1. Wipe area thoroughly with tack rag
   2. Remove all dust and lint
   3. Do not touch with hands

5. Mix Paint
   1. Remove paint can lid
   2. Stir the paint thoroughly
      a. Mix the binder, pigment, and solvent
      b. Use a paint stirring paddle
      c. Be sure to completely dissolve the ingredients
   3. Remove paint cup
   4. Place strainer in cup
   5. Pour needed amount of paint into strainer
      Note: For repair the size of this sheet of paper use 1/3 pint of paint
   6. Add the proper thinning solvent
      Note: Read can mixing instructions for proper amount of thinning solvent
   7. Restir the paint and solvent in the cup
   8. Place the cup on the gun
   9. Attach pressure hose
   10. Set air pressure at 30 lbs at the gun

6. Make a Test Panel
   1. Place sheet of paper on wall to test pattern
   2. Set pattern control for spot repair
   3. Spray metal test panel for color testing
      a. Completely cover exposed strip of panel
      b. Let flash and compare with color on vehicle

c. If color is correct, proceed

7. Apply Topcoat

1. Recheck the air pressure
2. Retest the pattern toward the suction fan
3. Hold spray gun 6-8" from surface to be painted
   a. This distance is about the width of the hand from the tip of the thumb when the hand is stretched out
   b. Distance is from nozzle to surface
4. Hold the gun level
   a. It must be at a right angle to the vertical surface
   b. On flat horizontal surfaces point the gun straight down
5. Move the spray gun parallel to the surface
   a. Keep a constant distance between the spray gun and the surface
   b. Follow the contours of the panel
   c. Do not arc the gun
6. Move the spray gun in a steady deliberate pass
   a. Move the gun at 1' per second
   b. Do not stop without first releasing the trigger
7. Hold the air hose with the other hand
8. Release the trigger at the end of each pass
9. Start gun movement outside the repair area and pull the trigger as the nozzle passes directly over the leading edge of the repair
10. Release the trigger as the gun reaches the other side of the primed area
11. Pull the trigger again as you begin the pass in the opposite direction
12. The second pass should overlap one-half the width of the first spray pattern
13. Keep the nozzle level with the edge of the first spray pass pattern
14. Continue process, triggering at the end of each pass until primed area is covered with one coat
15. Let it dry until the solvent has had time to dry (flash time)
16. Repeat single coat process until the repair area is no longer visible

17. Apply two more single coats

8. Apply Mist Coat
   1. Pour all but 1" of the paint remaining in the cup back into the paint can
   2. Add 2" of thinning solvent to the paint cup and stir
   3. Lower the line pressure to 20 lbs
   4. Apply single coat extending 2" beyond previous passes

9. Color Sand
   1. After final coat has dried look for small sandscratches
   2. Small scratches are removed by blocking with 600 grit wet-or-dry and a rubber sanding block
   3. Keep the area wet with water to remove sanding residue
   4. Dry area and add more color coats if necessary

10. Drying Time
   1. Allow surface to dry minimum of 4 hours, preferably overnight
   2. Premature finishing will spoil the job

11. Clean Spray Gun
   1. Clean the paint gun
      a. Remove the paint cup
      b. Lift suction tube above liquid level
      c. Unscrew the air nozzle about three turns to the left (counterclockwise)
      d. Hold a clean cloth over the air cap
      e. Pull the trigger
      f. This forces paint from the gun back into cup
      g. Pour unused paint back into paint can
      h. Pour paint cup 1" deep with clean thinner
      i. Replace cup onto paint gun
      j. Retighten air nozzle turn to right (clockwise)
      k. Pull the trigger to flush the paint left in the gun
   2. Clean the nozzle
      a. Remove
      b. Soak in lacquer thinner
      c. Dry with compressed air
   3. Thoroughly clean cup and gun
      a. Use lacquer thinner

		b. Use soft cleaning brush c. Remove all traces of paint
		4. Pour out dirty thinner
		5. Pour 1" of clean thinner in paint cup
		6. Place nozzle in cup
		7. Replace cup on paint gun
		8. Replace gun in storage cabinet
12.	Compound Repair	1. Compound by hand
		2. Compound entire panel
		3. Bring out the true color in the paint
		4. Remove the overspray from around the repair
		5. The repair area should blend in with the rest of the panel
13.	Clean Up	1. Clean tools and return to storage area
		2. Secure hoses and valves
		3. Clean paint booth

III. APPLICATION (PRACTICE BY LEARNER UNDER CLOSE SUPERVISION)

1. Students to practice applying acrylic lacquer to spot repair area using job and task sheets VII-B-1(J).
2. Observe and reteach, if the need arises, the spot repair topcoat application process.
3. Check students for key points.
4. Have students repeat key points as they perform tasks.

IV. VERIFICATION AND/OR EVALUATION (CHECK ON STUDENT'S ABILITY)

Put students on their own to perform tasks (performance test).

V. SUMMARY (TELL THE STEPS ON PROCEDURE AS TO WHAT, HOW, AND WHY. REVIEW CHECKING STANDARDS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENTS)

1. Repeat the steps from Stage II.
2. Emphasize the key points in Stage II.
3. Emphasize safety.

SUGGESTED READING FOR THE STUDENT:

Auto Body Repairing and Refinishing, pp. 173-202
Collision Repair Guide, pp. 205-225
The Principles of Auto Body Repairing and Repainting, pp. 361-454
Automotive Refinishing Principles and Techniques, pp. 65-90
Refinisher's Guide, pp. 21-23, 35-41
A Guide to Better Automotive Refinishing, pp. 21-23

The Next Lesson Is: VII-B-2(S), "Make Panel Repair Topcoat Application (Acrylic Lacquer)"

JOB:	Make Spot Repair Topcoat Application (Acrylic Lacquer)	
MATERIALS:	Acrylic lacquer paint, lacquer thinner, clean shop towels	
TOOLS AND EQUIPMENT:	Compressed air, air hose, suction type paint gun, mixing paddle, strainers	
GENERAL INFORMATION:	Before beginning this job the student should have prepared the surface according to lesson VII-A-1(J), "Prepare Surface for Refinishing Spot Repair"	
PROCEDURES AND/OR TASKS:	VII-B-1(TSa)	Preparation
	VII-B-1(TSb)	Mix Paint
	VII-B-1(TSc)	Make Test Panel
	VII-B-1(TSd)	Apply Topcoat
	VII-B-1(TSe)	Color Sand (If Necessary)
	VII-A-1(TSm)	Clean Paint Gun
	VII-B-1(TSf)	Compound Area
	VII-A-1(TSn)	Clean Up

TASK: Preparation

JOB: Make Spot Repair Topcoat Application (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Dusting gun, masking paper, masking tape, tack rag

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Remove Tape and Paper	1. Start tape off and pull at 90° angle to the tapped area 2. Remove all tape and paper from around repair area 3. Water and dust has probably accumulated under the mouldings and must be removed 4. Place vehicle in painting area
2. Dust Surface	1. Dust surface and cracks with dusting gun 2. Remove all water, sanding residue, and dirt 3. Make final inspection of surface for small sandscratches that need to be removed
3. Final Masking	1. Retape and paper surrounding panel a. Place paper and tape as close to the repair panel as possible without touching it b. Depending on how far the repair is from the adjacent panel, use one or two widths of paper 2. Tape outside edges of paper down to keep them from getting on the repair
4. Tack Wipe	1. Wipe area thoroughly with tack rag 2. Remove all dust and lint 3. Do not touch with hands

TASK: Mix Paint

JOB: Make Spot Repair Topcoat Application (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND EQUIPMENT: Paint strainers, mixing paddle, can opener, suction type paint gun

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Open the Paint Can	1. Remove the paint can lid with a lid removing tool 2. Be careful not to spill the paint or fill the lid well 3. Use the paint stirring paddle to wipe the paint from inside the lid
2. Stir the Paint in the Can	1. Stir thoroughly 2. Mix the binder, pigment, and solvent 3. Use a paint stirring paddle 4. Be sure to completely dissolve the ingredients
3. Mix the Paint in the Paint Cup	1. Remove the paint gun cup 2. Place strainer in cup 3. Pour needed amount of paint into strainer Note: For repair the size of this sheet of paper use 1/3 pint of paint 4. Add the proper thinning solvent Note: Read the can mixing instructions for proper amount of thinning solvent 5. Restir the paint and thinner in the paint cup 6. Replace the cup in the spray gun 7. Attach pressure hose 8. Set pressure a. Visually inspect the air line regulator b. Set the line pressure at 30 lbs

TASK: Make Test Panel

JOB: Make Spot Repair Topcoat Application (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND MATERIALS: 36" masking paper, masking tape, spray gun with paint

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Place Sheet Of Paper On Wall	1. Use 36 inch wide masking paper 2. Tear off suitable length (approximately 3 to 4 feet) 3. Tape securely to wall at eye level
2. Adjust Spray Gun	1. Adjust spray pattern a. Turn pattern valve (top valve on gun) clockwise all the way in to pin point pattern b. Turn pattern valve counterclockwise approximately 1 1/4 turns 2. Adjust fluid valve (bottom valve on gun) a. Turn fluid valve clockwise all the way in b. Turn fluid valve counterclockwise approximately 3 full turns
3. Test Spray Pattern	1. Use recommended spraying techniques for material being sprayed 2. Width of spray pattern should be approximately 4 inches wide (re-adjust pattern valve if necessary) 3. Fluid output should be sufficient to cover but not heavy enough to run or sag. (Re-adjust fluid valve if necessary)
4. Complete Test Panel	1. Spray 4 passes across the test panel 2. Overlap pattern of each spray pass approximately 50% Caution: Do not allow spray patterns to extend beyond edges of paper test panel 3. Allow test panel to dry 4. If satisfied with results, remove paper from wall and discard into trash can

TASK: Apply Topcoat

JOB: Make Spot Repair Topcoat Application (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND MATERIALS: Spray gun with paint

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Make Final Check Of Surface	1. Make visual inspection of masked areas and correct any flaws 2. Dust surface to be painted with air from the spray gun
2. Make Final Check Of Equipment	1. Check air pressure (30 psi at gun) 2. Make sure paint cup is attached securely to gun 3. Check condition of filter cartridge in respirator mask Caution: All painting should be done in a well-ventilated area, using an approved respirator mask
3. Apply Paint	1. Use correct spraying techniques for the material being sprayed a. Distance from gun to surface should be approximately one hand span b. Keep the gun level c. Move the gun parallel to the surface d. Move the gun in a steady, deliberate pass, approximately 1 foot per second e. Overlap each pass one-half the width of the previous pattern f. Trigger the gun at the beginning and end of each spraying pass 2. Continue this process until one full wet coat has been applied to the repaired area 3. Allow this first coat to dry 15 to 20 minutes 4. Repeat this single coat process until the repaired area has been covered with at least 6 coats
4. Apply Mist Coat	1. Prepare paint a. Pour all but 1/2 inch of paint remaining in cup back into the original paint can

STEPS	KEY POINTS
	b. Add one inch of lacquer thinner to the paint cup c. Stir thoroughly 2. Reduce the air pressure to 20 psi at the gun 3. Apply one full wet coat to the painted area a. Use the same technique as before b. Extend this mist coat approximately 2 to 4 inches out beyond the edges of the previously painted area

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TASK: Color Sand

JOB: Make Spot Repair Topcoat Application (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND MATERIALS: Spray gun with paint, 600 grit sandpaper, rubber sanding block, water

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Prepare For Sanding	1. Allow final mist coat to dry 2 to 4 hours 2. Load rubber sanding block with 600 grit, wet or dry sandpaper with the grit across the flat side of block 3. Inspect painted area for any small sand scratches
2. Sand Painted Area	1. Flood painted area with water a. Use water hose with just a slight trickle of water b. Use a clean bucket and sponge 2. If sand scratches are present, sand across the scratch with rubber block and sandpaper Note: Use very little hand pressure when color sanding 3. Continue sanding lightly until scratches disappear 4. Keep area flooded with water 5. Avoid sanding through paint film if possible 6. Remove sandpaper from block and fold into hand-sized pad 7. Use this pad to lightly sand the remainder of the repainted area 8. Sand out approximately 2 inches onto the original finish

TASK: Compound Area

JOB: Make Spot Repair Topcoat Application (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND MATERIALS: Polishing cloth, power polishing buffer with lambs wool bonnet, polishing compound, dusting gun

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Prepare Area	1. Dry color sanded surfaces with air pressure and clean cloth 2. Blow and wipe all water and sanding residue out from cracks or underneath moldings Note: Do not remove any masking tape or paper at this time in case any repainting becomes necessary
2. Compound The Sanded Area	1. Use a fine grit polishing compound
a. Power Buffer	2. Use an air or electric powered polishing buffer Caution: If an electric buffer is used, all water must be mopped and dried up in the work area and on the auto surface to minimize danger of electrical shock 3. With either kind of buffer, use a clean lamb's wool pad with cupped edges 4. Use a soft paint brush to apply a small amount of compound to the painted surface 5. Bring the forward, or leading, edge of the pad into contact wit' the compound 6. Keep the pad almost flat to the surface but with the rear, or trailing, edge raised just slightly 7. Keep buffer moving at a slow steady speed 8. Use very little pressure on the buffer Caution: Be very careful compounding around sharp ridges or creases, cracks, joints, and moldings 9. Continue until entire painted surface has been compounded Note: A power buffer works best on a relatively flat, uncluttered surface
b. Buff By Hand	1. Use clean soft polishing cloths

STEPS	KEY POINTS
	2. Fold into a hand-sized pad Note: A somewhat coarser compound may be used when hand rubbing 3. Apply small amount of compound to pad 4. Rub compound into painted surface a. Use medium hand pressure b. Use straight even strokes 5. Continue rubbing until compound has all been rubbed away 6. Re-fold cloth pad to a clean surface and re-apply compound as needed 7. Continue process until entire surface has been compounded and a good gloss has been obtained

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INSTRUCTOR'S PLAN VII-B-2(S)
MANIPULATIVE LESSON

TASK:	Make Panel Repair Topcoat Application (Acrylic Lacquer)
AIM:	The student will be able to make the topcoat application of a panel repair using a syphon type spray gun.
TOOLS AND EQUIPMENT:	Compressed air, air hoses, suction type paint gun, mixing paddle, strainers
MATERIALS:	Acrylic lacquer paint, lacquer thinner, clean shop towels
TEACHING AIDS:	
REFERENCES:	Auto Body Repairing and Repainting, pp. 173-202 Collision Repair Guide, pp. 205-225 The Principles of Auto Body Repairing and Repainting, pp. 361-454 Automotive Collision Work, pp. 333-365 Automotive Refinishing Principles and Techniques, pp. 65-90 Refinisher's Guide, pp. 21-22, 23, 35-41 A Guide to Better Automotive Refinishing, pp. 21-23
PREREQUISITE EXPERIENCE OF THE LEARNER:	The learner must have prepared the surface following the procedures in lesson VII-A-2(S), "Prepare Surface for Complete Panel Refinishing"
CHECKING STANDARDS:	1. Selection of materials. 2. Proper preparation and application of topcoat. 3. Appearance of topcoat. 4. Proper use of tools and equipment.

I. PREPARATION (OF THE LEARNER - MOTIVATION)

Complete panel refinishing is much the same as spot refinishing. There are a few changes in air pressure setting, pattern control, and painting techniques.

The basic steps are outlined in this lesson and the test will be on the student's ability to properly apply a topcoat to a complete panel.

II. PRESENTATION (OF THE SKILLS)

STEPS	KEY POINTS (THINGS TO REMEMBER TO DO OR SAY)
1. Preparation	1. Remove tape and paper from around repaired panel 2. Water has probably accumulated under mouldings or around panel opening and must be removed

	3. Place vehicle in painting area
2. Dust Surface	1. Dust surface and cracks with dusting gun 2. Remove all water, sanding residue, and dirt 3. Make final inspection of surface for small sandscratches that need to be removed
3. Final Masking	1. Retape and paper surrounding panel a. Place paper and tape as close to the repair panel as possible without touching it b. Place two 18" widths of paper around the panel c. Tape outside edges of paper down to keep them from getting in the repair
4. Tack Wipe	1. Wipe complete panel with tack rag 2. Remove all dust and lint 3. Do not touch panel with hands
5. Mix Paint	1. Stir the paint thoroughly 2. Place strainer in clean paint cup 3. Pour needed amount of paint into strainer 4. Add the proper thinning solvent Note: Read the mixing instructions for proper amount of thinning solvent 5. Restir the paint and solvent in the cup 6. Attach gun to cup, attach air pressure 7. Change air pressure to 45 lbs at the gun
6. Make a Test Panel	1. Place sheet of paper on wall to test pattern 2. Set pattern open for panel painting 3. Spray metal test panel for color matching a. Completely cover exposed strip of panel b. Let flash and compare with color on vehicle c. If color is correct, proceed
7. Apply Topcoat	1. Recheck air pressure 2. Retest the pattern toward the suction fan 3. Hold paint gun 6-8" from surface to be painted 4. Hold gun level 5. Move gun parallel to surface

6. Do not arc the gun
7. Hold the air hose with the other hand
8. Release the trigger at the end of each pass
   Note: On panel refinishing, try to make a single pass the complete length of the panel
9. Start the pass outside the panel area, pull the trigger just before the nozzle passes directly over the edge of the panel
10. Release the trigger as the gun reaches the other edge of the panel
11. Pull the trigger again as you begin the pass in the opposite direction
12. The second pass should overlap one-half the width of the first spray pattern
13. Cover the complete panel
14. Let it dry until the solvent has flashed
15. Apply two more single coats

8. Apply Mist Coat
   1. Pour all but 1" of the paint remaining in the cup back into the paint can
   2. Add 2" of thinning solvent to the paint cup and stir
   3. Lower the line pressure to 20 lbs
   4. Apply single coat to entire panel

9. Color Sand
   1. Allow surface to dry minimum of 4 hours, preferably overnight
   2. Premature finishing will spoil the job

10. Drying Time
    1. After final coat has dried look for small sand scratches
    2. Small scratches are removed by blocking with 600 grit wet-or-dry and a rubber sanding block
    3. Keep the area wet with water to remove sanding residue
    4. Dry area and add more color coats if necessary

11. Clean the Spray Gun
    1. Clean the paint gun
       a. Remove the paint cup
       b. Lift suction tube above liquid level
       c. Unscrew the air nozzle about three turns to the left (counterclockwise)
       d. Hold a clean cloth over the air cap
       e. Pull the trigger
       f. This forces paint from the gun back into cup

g. Pour unused paint back into primer-surfacer can
h. Pour paint cup 1" deep with clean thinner
i. Replace cup onto paint gun
j. Retighten air nozzle turn to right (clockwise)
k. Pull the trigger to flush the paint left in the gun

2. Clean the nozzle
   a. Remove
   b. Soak in lacquer thinner
   c. Dry with compressed air
3. Thoroughly clean cup and gun
   a. Use lacquer thinner
   b. Use soft cleaning brush
   c. Remove all traces of paint
4. Pour out dirty thinner
5. Pour 1" of clean thinner in paint cup
6. Place nozzle in cup
7. Replace cup on paint gun
8. Replace gun in storage cabinet

12. Compound the Panel

1. Apply compound to panel
   a. Use a soft rag
   b. Dab the compound to the surface and smooth out
2. Buff the panel
   a. Use electric or air driven buffer
   b. Use the machine in much the same manner you would use on electric grinder
3. Do not let the buffer ride in one place
4. Keep the buffer on a 5 degree angle
5. Keep two hands on the buffer
6. Keep compounding the area until the panel shines properly
7. Keep the electrical cord clear of the buffing pad

Note: All edges and creases should be compounded by hand to avoid burning through the paint film

13. Clean Up

1. Clean tools and return to storage room
2. Secure hoses and valves
3. Clean paint booth

III. APPLICATION (PRACTICE BY LEARNER UNDER CLOSE SUPERVISION)

1. Students to practice applying acrylic lacquer in complete panel application using job and task sheets VII-B-2(J).
2. Observe and reteach, if the need arises, the complete panel topcoat application process.
3. Check students for key points.
4. Have students repeat key points as they perform tasks.

IV. VERIFICATION AND/OR EVALUATION (CHECK ON STUDENT'S ABILITY)

Put students on their own to perform tasks (performance test).

V. SUMMARY (TELL THE STEPS ON PROCEDURE AS TO WHAT, HOW, AND WHY. REVIEW CHECKING STANDARDS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENTS)

1. Repeat steps from Stage II.
2. Emphasize key points.
3. Emphasize safety.

SUGGESTED READING FOR THE STUDENT:

Auto Body Repairing and Refinishing, pp. 173-202
Collision Repair Guide, pp. 205-225
The Principles of Auto Body Repairing and Repainting, pp. 361-454
Automotive Collision Work, pp. 333-365
Automotive Refinishing Principles and Techniques, pp. 65-90
Refinisher's Guide, pp. 21-23, 35-41
Guide to Better Automotive Refinishing, pp. 21-23

The Next Lesson Is: VII-B-3(S), "Apply and Finish Overall Topcoat (Acrylic Lacquer)"

JOB:	Make Panel Repair Topcoat Application (Acrylic Lacquer)
MATERIALS:	Acrylic lacquer, lacquer thinner, strainers, paddles, masking tape, tac rag
TOOLS AND EQUIPMENT:	Suction type paint gun, air supply, dusting gun
GENERAL INSTRUCTIONS:	Before beginning this job the student should have prepared the surface according to lesson VII-A-2(J), "Prepare Surface For Complete Panel Refinishing"

PROCEDURES AND/OR TASKS:

VII-B-2a(TS)	Make Final Preparations
VII-B-1b(TS)	Mix Paint
VII-B-1c(TS)	Make Test Panel
VII-B-2b(TS)	Apply Topcoats
VII-B-1e(TS)	Color Sand
VII-A-1m(TS)	Clean Paint Gun
VII-B-1f(TS)	Compound Area
VII-A-1n(TS)	Clean Up

TASK: Make Final Preparations

JOB: Make Panel Repair Topcoat Application (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND MATERIALS: Spray gun with paint

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Adjust Air Pressure	1. Slightly higher air pressure should be used when painting a complete panel 2. Adjust pressure to read 45 lbs at the gun Note: On some metallic paints the color may actually be lightened or darkened by adjusting the air pressure. As a rule, the color will become lighter as the air pressure is raised
2. Adjust Paint Gun	1. Adjust spray pattern a. Top valve on paint gun b. Turn out counterclockwise to achieve the widest possible spray pattern, approximately 8 inches 2. Adjust fluid output a. Bottom valve on paint gun b. Turn valve clockwise until it stops c. Turn valve counterclockwise 4 complete turns Note: This adjustment may be changed as necessary for different types and viscosity of paints

TASK: Apply Topcoats

JOB: Make Panel Repair Topcoat Application (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND MATERIALS: Spray gun with paint

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Apply Base Coat	Note: Use the same spraying techniques as spot painting in regard to gun distance, travel speed, and handling 1. Paint around all edges of panel (referred to as "banding") 2. Make first spray pass across panel 3. Start at top and work toward bottom 4. Begin pass outside panel area and pull the trigger just before the nozzle passes over the edge of the panel 5. Release the trigger after the nozzle passes over the opposite edge of panel 6. Overlap each spray pass pattern approximately 50% 7. Alternate passes from left to right and right to left Note: Whenever possible, each pass should run the entire length of the panel, with no pause or overlap in the middle 8. Continue in this manner until entire panel has been covered with one full wet coat
2. Apply Finish Coats	1. Allow base coat to dry for 20 to 30 minutes 2. Use same procedure to apply successive coats of paint to entire panel 3. Allow each coat to "flash", or dry approximately 5 minutes before next coat is applied 4. Panel need not be "banded" with these finish coats 5. Continue until at least 4 finish coats have been applied Note: Some colors may require up to 6 or 8 coats to insure full coverage

STEPS	KEY POINTS
3. Apply Mist Coat	Note: This should be done immediately after the last finish coat has been applied and is still wet 1. Thin remaining paint approximately 100% with lacquer thinner 2. Stir thoroughly 3. Re-adjust air pressure to read 20 lbs at the gun 4. Apply one full wet coat to the entire panel

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INSTRUCTOR'S PLAN VII-B-3(S)
MANIPULATIVE LESSON

TASK:	Apply and Finish Overall Topcoat (Acrylic Lacquer)
AIM:	The student will be able to make a complete topcoat application to a vehicle
TOOLS AND EQUIPMENT:	Compressed air, air hose, suction type paint gun, paint stirring paddle, blower nozzle or dusting gun, respirator mask, power buffer
MATERIALS:	Tack rag, paint strainers, acrylic lacquer apint, lacquer thinner, additives, clean shop towels, rubbing compound, polishing cloth
TEACHING AIDS:	
REFERENCES:	Automotive Refinishing Principles and Techniques, pp. 65-90 The Principles of Auto Body Repairing and Repainting, pp. 361-454 Information Sheet VII-B-1(Sb)
PREREQUISITE EXPERIENCE OF THE LEARNER:	The learner must have prepared the vehicle for refinishing following the procedures in lesson VII-A-3(S) "Prepare Surface for Overall Refinish of Topcoat"
CHECKING STANDARDS:	1. Selection of materials 2. Proper preparation and application of topcoat 3. Appearance of topcoat 4. Proper use of tools and equipment 5. Observance of safety rules

I. PREPARATION (OF THE STUDENT - MOTIVATION)

In one sense, the topcoat is the most important operation in auto body repair. It is the topcoat the customer sees first and uses to judge the quality of your work. A good painter takes pride in producing a beautiful finish that matches or exceeds the original finish in texture and luster.

Overall refinishing is much the same as panel refinishing. There are a few changes in air pressure setting, pattern control, and painting techniques. The basic steps are outlined in this lesson, and the test will be on the student's ability to properly apply an overall topcoat.

II. PRESENTATION (OF THE SKILLS)

STEPS	KEY POINTS (THINGS TO REMEMBER TO DO OR SAY)
1. Preparation	1. Perform all tasks outlined in lesson VII-A-3(S) "Prepare Surface for Overall Refinishing"

2. Place vehicle in ventilated painting area or booth
3. Assemble all needed supplies and materials
4. Turn on fan
5. Wet down paint booth floor with water hose
6. Remove masking tape and paper as necessary for cleaning

   Note: Water and sanding residue has probably accumulated under moldings or masked areas and must be removed before refinishing operation begins

2. Cleaning

1. Dust surface and panel joints with dusting gun or blower nozzle
2. Remove all traces of water from underneath moldings and around panel joints
3. Wipe down entire surface with cleaning solvent and clean shop towel
4. Tack wipe entire surface with tack rag

3. Final masking

1. Remask all glass and chrome
2. Tape all joints in masking paper to avoid overspray leakage
3. Cover wheels

4. Tack wipe

1. Wipe down complete vehicle with tack rag
2. Remove all dust and lint
3. Avoid touching surface with hands

   Note: Natural oils from the skin could contaminate the surface, causing problems in the topcoat

5. Mix paint

1. Stir paint thoroughly

   Note: This step is most important. If pigment or metallic particles are not completely mixed, the sprayed material may not be a true, exact color
2. Add proper amount of lacquer thinner
   a. Follow paint manufacturer's recommendations as to paint thinner ratio
   b. Use proper thinner for shop conditions and temperatures
3. Add any special additives
   a. Fish eye preventer
   b. Retarder

   Note: For a slower drying time, up to 10%

	by volume of retarder may be used 4. Stir thoroughly 5. Strain into clean paint cup Note: Enough paint should be mixed at one time to allow complete coverage of the vehicle without stopping to remix 6. Attach cup to paint gun
6. Refinish hidden surfaces	Caution: Always wear respirator mask when painting 1. Adjust air pressure to 20-25 lbs. pressure 2. Adjust spray pattern to small oval pattern 3. Refinish all hidden surfaces a. Inside door edges and door jambs b. Under-side of hood and trunk compartment c. Behind gas filler door 4. Allow each coat to flash, or grow dull, before applying next coat 5. Apply sufficient number of coats to insure full coverage 6. Leave doors, trunk lid, and hood slightly ajar to avoid sticking, and to permit proper drying
7. Make test panel	1. Readjust air pressure to 40-45 lbs. pressure at the gun 2. Tape sheet of masking paper to wall 3. Make several spray strokes on paper to check pattern a. Adjust spreader valve for large open pattern b. Adjust fluid control valve for full wet coverage
8. Apply topcoat	1. Hold gun at right angles to painting surface 2. Gun distance from surface should be one handspan or approximately 6 to 8 inches 3. Alternate right and left painting strokes 4. Use smooth, steady stroke a. Too fast stroke produces a dry dull finish with spotty coverage b. Too slow stroke may produce sags or runs and wastes material 5. Overlap patterns approximately 50% 6. Trigger gun at beginning and end of each stroke

Note: This is a very important part of the spraying technique. It maintains full coverage, minimizes overspray, and cuts down on the amount of material wasted. It also lessens the chance of runs or sags due to excessive paint build up at ends of stroke

7. Spray top panel first
   Note: When spraying top, hood, or other wide horizontal surface, start at near side and work toward far side. In this manner the overspray lands on a dry surface and will be dissolved into the paint from succeeding strokes
8. Cover entire vehicle, painting one panel at a time
   Note: Panel sequence is not of great importance, but as a general rule, spray top, right doors, right quarterpanel, trunk, left quarterpanel, left doors, right front fender
9. Spray 3 or 4 full wet coats over entire surface
10. Allow each coat to flash or grow dull before applying succeeding coats
    Note: When spraying metallic type paints it may be necessary to alternate direction of spraying coats, (one coat sprayed with horizontal strokes, the next with vertical strokes) to eliminate metallic streaks

9. Apply mist coat
   1. Allow final color coat to flash
   2. Mix paint to a 2 parts color / 8 parts lacquer thinner mixture
   3. Strain into clean paint cup
   4. Adjust air pressure to 20-25 lbs. pressure at the gun
   5. Spray two medium coats over entire vehicle following same procedures as used in applying color coats
      Note: Some painters use a special premixed product for this mist coat. When using this type product, refer to manufacturer's recommendations for spraying

10. Inspection
    1. Check for thorough, even coating of entire vehicle

2. Inspect for runs, sags, or dry spots

11. Repair any blemishes

1. Repair dry spots or streaks
   a. Use same paint thinner mixture as used in mist coat
   b. Use same air pressure
   c. Spray 2 wet coats on the affected area immediately
2. Repair runs or sags
   a. Allow area to dry thoroughly (approximately one hour)
   b. Block sand affected area
      1. Use #600 grit sandpaper
      2. Use a rubber sanding block
      3. Use very little water
   c. Dry surface with blower nozzle and clean shop towel
   d. Tack wipe sanded surface and surrounding area with tack rag
   e. Use same paint thinner mixture and air pressure as used in mist coat
   f. Apply 2 wet coats to the sanded area
   g. Allow to flash
   h. Apply 2 more wet coats to the area
      Note: Extend these 2 coats approximately 4 to 6 inches beyond the outer edges of the first 2 coats
   i. Follow immediately with 1 medium coat around the outer edges of repaired spot only overlapping edges approximately 6 to 8 inches
   j. With all blemishes repaired to satisfaction, proceed

12. Drying time

1. Allow final coat to air dry at least 4 hours
2. Overnight drying is preferred
3. May be force dried at approximately 165°F for one to two hours
   Caution: When force drying, do not exceed 165°F temperature, as damage to plastic moldings or soft trim may result
4. Allow to cool before compounding

13. Clean spray gun and other equipment

1. Clean paint gun (refer to task sheet VII-A-1(TSm)
2. Remove vehicle from paint room

3. Clean and secure air hoses and regulator
4. Clean paint room
   a. Remove all paint and mixing materials from paint room
   b. Sweep and pick up all trash and debris
   c. Wash down walls and floor with water hose

14. Color sand (if necessary)

Note: Allow recommended drying time before color sanding. Attempting to color sand too soon will damage the new paint film

1. Use #600 grit sandpaper
2. Use enough water to flush sanding residue from surface
3. Use very light hand pressure
4. Sand entire vehicle

   Note: A rubber sanding block may be used if desired to avoid finger marks
5. Dry vehicle with blower nozzle and clean shop towel

15. Compound
   a. By hand

1. Use a fast cut rubbing compound
2. Use clean, lint free cloths
   a. Cheese cloth
   b. Terry cloth or towel material

   Note: Avoid using the red shop rag rental type towels, as the chemicals used by the cleaning companies could contaminate the finish
3. Dampen cloth with water and fold into hand size pad
4. Apply compound to pad
5. Apply to painted surface
   a. Use straight, even strokes
   b. Use sufficient pressure to insure good penetration of paint film
   c. Rub small areas at a time
   d. Overlap areas to eliminate streaks
   e. As one side of pad becomes soiled re-fold to a clean side
   f. Continue rubbing until entire vehicle is compounded

   b. Use power buffer

Note: This procedure is the same when using either air or electric powered buffer

1. Use clean compounding pad on buffer
2. Apply compound to small area of painted

surface
   a. Use medium bristled paint brush
   b. Use plastic squeeze bottle

   Note: Compound should be thinned slightly when using power buffers. Use clean water and mix to a smooth, creamy texture
3. Use very light pressure on buffer
4. Tilt buffer at approximately 5° to the painted surface
5. Use only the outer 2 inches of the buffer pad
6. Keep buffer moving to avoid burning through the paint film
7. Clean buffer pad often to prevent compound from caking up in the pad
   a. Use pad cleaning tool
   b. Use wire brush
8. Continue compounding until entire vehicle has been covered

16. Polishing

1. Install lamb's wool polishing bonnet on buffer
2. Use very light pressure on buffer
3. Move buffer slightly faster than moved when compounding

   Note: A small amount of water may be sprinkled on painted surface to speed up polishing
4. Polish small area at a time
5. Continue polishing until all compounding streaks are removed and a high luster is obtained

17. Clean up vehicle

1. Remove all masking tape and paper
2. Clean all moldings, bumpers, and grille
3. Use clean polishing cloth and blower nozzle

   Note: Any moldings or decals that have been removed should be installed at this time
4. Clean glass areas
5. Clean and vacuum inside of vehicle
6. Scrub tires and wheels with soap and water, if necessary

18. Clean work station

1. Return all tools and equipment to storage area

2. Sweep and pick up all trash and debris
3. Use mop or squeegee to clean up all water

III. APPLICATION (PRACTICE BY LEARNER UNDER CLOSE SUPERVISION)

1. Have students practice the complete process of applying a complete overall topcoat using the procedures outlined
2. Check students for key points of each step
3. Observe and reteach, if need arises, the complete overall topcoat application process

IV. VERIFICATION AND/OR EVALUATION (CHECK ON STUDENT'S ABILITY)

Put students on their own to perform tasks (performance test)

V. SUMMARY (TELL THE STEPS ON PROCEDURE AS TO WHAT, HOW, AND WHY. REVIEW CHECKING STANDARDS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENTS.)

1. Review all steps from stage II
2. Emphasize key points
3. Emphasize safety
4. Knowing how to do a refinish job, doing it right, and taking pride in this accomplishment is the mark of a true professional

SUGGESTED READING FOR THE STUDENTS:

Automotive Refinishing Principles and Techniques, ch. XIV
The Principles of Auto Body Repairing and Repainting, pp. 448-453
Total Auto Body Repair, pp. 462-468
Pass out information sheet VII-B-4(IS) "Painting Problems"

The Next Lesson Is: VII-4-(I) "Determine Cause of Painting Problems"

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JOB: Apply And Finish Overall Topcoat (Acrylic Lacquer)

MATERIALS: Paint, paint thinner, strainers, paddles, rubbing compound, polishing cloth

TOOLS AND EQUIPMENT: Air supply, spray gun, blower nozzle, respirator mask, power buffer

GENERAL INSTRUCTIONS: Before beginning this job the student should have prepared the vehicle for overall refinishing according to Lesson VII-A-3(J) "Prepare Surface For Overall Refinish Of Topcoat". The procedures involved in overall refinishing are much the same as panel refinishing, with but very few changes

PROCEDURES AND/OR TASKS:

VII-B-2a(TS)	Make Final Preparations
VII-B-1b(TS)	Mix Paint
VII-B-1c(TS)	Make Test Panel
VII-B-3a(TS)	Refinish Hidden Surfaces
VII-B-3b(TS)	Apply Topcoats
VII-B-3c(TS)	Finish Spraying Operation
VII-A-1m(TS)	Clean Paint Gun
VII-B-1e(TS)	Color Sand
VII-B-1f(TS)	Compound Area
VII-A-1n(TS)	Clean Up

TASK: Refinish Hidden Surfaces

JOB: Apply And Finish Overall Topcoat (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND MATERIALS: Spray gun with paint, respirator mask

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Clean Surfaces	1. Use cleaning solvent and clean shop towels to remove any oil or grease from around door hinges, door locks, striker plates, trunk locks, and hood latch and hinges 2. Use a solvent brush, if necessary, to clean thoroughly 3. Avoid getting dirty solvent out onto prepared, sanded surfaces 4. While solvent is still wet, wipe immediately with clean dry shop towels 5. Clean under hood, inside door edges, door jambs, underside of trunk lid, trunk compartment edges, and behind gas filler door (if any)
2. Sand Surfaces	1. Use 360 grit sandpaper 2. Use no water when sanding these surfaces 3. Sand surfaces completely 4. Fold sandpaper as necessary to sand cracks, creases, and hard to reach areas
3. Apply Paint	1. Use blower nozzle to blow any sanding dust or dirt from prepared surfaces 2. Wipe sanded surfaces down with tac rag 3. Reduce air pressure to read 20 lbs at the gun 4. Adjust spray gun a. Small oval pattern b. Fluid output for medium-wet application 5. Refinish all prepared areas Note: Apply only enough paint needed to insure full coverage. Allow each coat to flash before proceeding 6. Leave doors, trunk lid, and hood slightly ajar until painted surfaces are completely dry

TASK: Apply Topcoats

JOB: Apply And Finish Overall Topcoat (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND MATERIALS: Spray gun with paint, tac rag, 400 grit sandpaper

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Final Preparation	1. Close doors, hood, and trunk lid 2. Inspect outer surface of vehicle for overspray, particularly around edges of previously painted hidden areas 3. Use 400 grit sandpaper as necessary to remove all overspray 4. Re-adjust air pressure to 45 lbs 5. Use blower nozzle to dust off entire vehicle 6. Wipe off entire vehicle with tac rag
2. Apply Color Coats	1. Use same technique and procedures as when refinishing a panel 2. Start spraying at top of vehicle 3. Stand on paint bench if necessary to reach entire top 4. Begin spraying at nearest edge and work toward the middle of top 5. Move to opposite side of vehicle and reverse the procedure, beginning in the middle and working toward the near edge 6. Hold surplus air hose up with free hand to avoid dragging it on the vehicle surface 7. Paint entire vehicle, spraying one panel at a time a. Right side b. Trunk c. Left side d. Front end 8. Spray 4 full wet coats over complete surface of vehicle
3. Apply Mist Coats	1. Re-adjust air pressure to 25 lbs pressure at the gun 2. Mix paint to a 2 parts color / 8 parts lacquer thinner mixture

STEPS	KEY POINTS
	3. Mix up enough paint to apply 2 coats to entire vehicle 4. Spray 2 full medium wet coats over entire vehicle surface

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TASK: Finish Spraying Operation

JOB: Apply And Finish Overall Topcoat (Acrylic Lacquer)

TRADE: Auto Body Repair

TOOLS AND MATERIALS: Spray gun with paint, 600 grit sandpaper, rubber sanding block, clean shop towels, tac rag, blower nozzle, water, and bucket

TASK BREAKDOWN:

STEPS	KEY POINTS
1. Inspect Condition Of Topcoat	1. Thorough, even coating over surface of entire vehicle 2. Check for runs or sags caused by excessive paint buildup 3. Look for dry spots or streaks caused by poor gun handling techniques
2. Repair Blemishes	1. Repair these spots quickly as possible before the final topcoat has completely dried
a. Dry Spots Or Streaks	2. Use same paint / thinner mixture and air pressure as in mist coats 3. Apply 2 full wet coats to the affected area 4. Extend these coats to exceed the dry spot by 6 to 8 inches on all sides Note: If dryness or streak persists, paint should be thinned approximately 10% more and the area re-sprayed
b. Runs Or Sags	1. Allow affected area to dry thoroughly (until thumbnail will not make a mark on run) 2. Load 600 grit sandpaper onto rubber sanding block 3. Dip block into waterbucket to wet sandpaper 4. Block sand across run or sag 5. Use very light pressure on block 6. Dip block again as necessary to sandpaper wet 7. Dry sanded surface completely with blower nozzle and clean shop towel 8. Wipe area down with tac rag 9. Use same paint / thinner mixture and air pressure as used in mist coats 10. Spray 2 medium wet coats to the sanded area

STEPS	KEY POINTS
	11. Allow these coats to flash or dull out
	12. Spray 2 more full wet coats to the area
	13. Extend these coats 4 to 6 inches beyond edges of first coats
	14. Follow immediately with one medium wet coat around edges of area only, overlapping 6 to 8 inches

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INSTRUCTOR'S PLAN VII-B-4(I)
INFORMATIONAL LESSON

SUBJECT: Determine Cause and Cure of Painting Problems

AIM: The student will be able to determine the cause and cure of painting problems.

TEACHING AIDS: Transparencies Figs. AB VII-B, Figs. 17 - 27

MATERIALS: Sandpapers, undercoats, thinner/reducer, air source, suction type paint gun, paints, strainers, stirring paddles, special additives

REFERENCES: Refinisher's Guide, pp. 45-72
Automotive Refinishing Principles and Techniques, pp. 91-117
A Guide to Better Automotive Refinishing, pp. 38-50
Information sheet VII-B-4(IS) "Painting Problems"

PREREQUISITE EXPERIENCE OF THE LEARNER: The student must have studied information sheet VII-B-4(IS)

I. PREPARATION (OF THE STUDENT - MOTIVATION)

A sure way to earn more money in the automotive refinishing business is to complete more finished jobs per day. To increase work output, it is first necessary to increase work efficiency. One way to do this is by minimizing or eliminating painting problems, which can be costly in materials wasted and time spent unprofitably. This lesson illustrates some of the problems that may be encountered and the probable cause of each. The test will be on the student's ability to recognize these problems and determine the cause and the recommended cure for each.

II. PRESENTATION (OF THE INFORMATION)

INSTRUCTIONAL TOPICS TEACHING POINTS	THINGS FOR STUDENTS TO DO THINGS FOR INSTRUCTOR TO DO OR SAY
1. Causes of paint problems	1. Affects the texture and gloss of topcoat
a. Poor painting technique	a. Can cause rough, uneven topcoat
	b. Can cause dull, dry finish
	2. Can have direct effect on color match
	a. Causes metallic streaks
	b. Can cause color to be too light or too dark
	3. Wastes material
	a. Excessive overspray
	b. Excessive paint film buildup
	c. Runs or sags

4. Good painting techniques come from much practice

b. Improper material selection
1. May result in wasted materials
   a. Mixing incompatible materials or products
   b. Using material not suitable for job
2. Often causes blistering and lifting
   a. Spraying lacquer over enamel
   b. Using the wrong undercoats

c. Poor preparation
1. Causes loss of adhesion and peeling
   a. Contaminants left on surface prevent good topcoat bond
   b. Improper sanding prevents good penetration and bond of new paint film
2. Affects the appearance and durability of the the finished job
   Note: This is the most frequent cause of a majority of painting problems

2. Thinners/reducers
1. Can retard or speed up drying process
   a. Slow evaporation rate slows down drying time
   b. Fast evaporation rate speeds up drying time
2. Can affect gloss and texture of topcoat
   a. Proper thinner reducer allows smooth flow out of paint film
   b. Can minimize the effects of extreme temperature or humidity

3. Undercoats
1. Can cause or cure a paint problem
   a. Using wrong undercoat can cause loss of adhesion and peeling
   b. Use of correct undercoat provides good bond between old finish and new paint film
2. Can be used to cover up minor surface imperfections
3. Helps prevent rust

4. Paint problems cause, prevention, and cure

a. Adhesion loss and peeling
1. Causes
   a. Contaminants on surface prior to

painting
b. Use of wrong undercoat
c. Insufficient sanding of surface prior to painting

Show: Transparency: Fig. 17

d. Insufficient drying time
e. Improper mixing of materials

2. Prevention
   a. Thoroughly clean surface before and after sanding
   b. Use correct undercoat for type finish being applied
   c. Dry sand or water sand old finish thoroughly
   d. Use metal conditioner on bare metal areas
   e. Allow ample drying time between coats
   f. Follow manufacturer's label directions for mixing
3. Cure
   a. If affected area is small, repair technique is same as spot repair (refer to VII-A-1 and VII-B-1)
   b. If entire surface shows signs of poor adhesion, remove old finish and refinish complete vehicle, using correct procedures (refer to VII-A-3)

b. Blistering

1. Causes
   a. Moisture trapped between metal and undercoat or between undercoat and topcoat
   b. Small spots of surface contaminants
   c. Rapid temperature change
   d. Insufficient drying time of undercoats
2. Prevention
   a. Dry surface thoroughly
   b. Avoid touching surface with bare hands
   c. Allow metal and paint to come to equal temperature before spraying
   d. Allow sufficient flash time between coats to avoid trapping solvents
3. Cure
   a. If damage is extensive or severe, finish must be removed down to undercoat or bare metal, depending on depth of

blisters. Complete refinishing process is then repeated, using correct procedures as outlined in VII-A-3

b. If damage is less severe, blisters may be sanded out, resurfaced, block sanded, and refinished much like spot repair (refer to VII-B-1)

c. Blushing

Show Transparency: Fig. 18

1. Causes
   a. Hot humid weather
   b. Surface being sprayed is lower in temperature than surrounding atmosphere
   c. Poorly balanced lacquer thinners in undercoat and topcoat
   d. Insufficient flash time between coats
   e. Improper mixing of materials
2. Prevention
   a. If possible, avoid spraying acrylics and lacquers on rainy or extremely hot humid days
   b. Keep equal temperatures between surface, material, and shop
   c. Use correct thinners
   d. Allow ample flash time between coats
   e. Follow manufacturer's label directions for mixing
   f. Use a special additive retarder
3. Cure
   a. In minor cases, spray a medium coat of high grade thinner or retarder to redissolve the blushed film and restore normal appearance

   Note: If blushing is very slight it may be removed by polishing after paint film is thoroughly dry
   b. With more severe blushing, add up to 10% by volume of retarder to thinned paint and apply two or more coats as needed. Allow to flash between coats

d. Cracking

Show: Transparency: Fig. 19

1. Causes
   a. Insufficient drying time of undercoats
   b. Application of color film over wrong undercoats
   c. Excessive film buildup

d. Materials not properly mixed
e. Extreme temperature differences between shop, metal surface, and materials

2. Prevention
   a. Thin undercoats fully with proper amount of high grade thinner
   b. Stir undercoat and color mixtures thoroughly
   c. Allow shop, metal surface, and painting materials to come to equal temperatures before spraying
   d. Apply undercoats in medium thin coats, especially the first coat
   e. Allow each coat to dry thoroughly before applying succeeding coats
   f. Make sure undercoats and topcoats are of compatible materials
3. Cure
   a. Material in affected area must be removed down to depth of cracks (To bare metal, if necessary)
      1. Allow affected area to dry thoroughly
      2. Use grinder with #16 grit disc
      3. Use jitterbug sander with #40 grit sandpaper
   b. Finish the repairs according to procedures outlined in lesson VII-B-1

e. Line checking

1. Causes
   a. Much the same as cracking
   b. Application of new topcoat film over old finish which had already begun to check and was not removed
   c. Use of poor quality materials
   d. Application of new finish over undercoats which are too thick or not thoroughly dried
   e. Use of incorrect undercoats or sealers
   f. Excessive amounts of special additives (gloss improvers, intensifiers, emulsifiers, etc.)
2. Prevention
   a. Always use highest quality materials

b. Use compatible products
c. Mix according to manufacturer's label recommendations
d. Check condition of old finish before beginning any part of refinishing procedure
e. Allow ample drying time between coats of undercoat

3. Cure
   a. Follow the same procedures as when repairing a cracking problem
   b. Use procedures outlined in lesson VII-B-1 and refinish

   Note: If line checking damage is extensive it may be more practical to refinish entire vehicle

f. Micro checking

1. Causes
   a. Use of poor quality materials

   Note: Micro-checking could indicate the beginning of a complete breakdown of the paint film
   b. Excessive topcoat paint film thickness
   c. Improper use of special additives
   d. Insufficient stirring of materials to incorporate all the solids
2. Prevention
   a. Always use highest quality materials
   b. If job has previously been repaired, sand down thoroughly to reduce total film thickness
   c. Do not add anything to refinishing materials not specifically recommended by the material manufacturer
   d. Thin and mix according to label directions
   e. Stir all materials thoroughly
3. Cure
   a. Sand off enough of the topcoat film to remove checking

   Note: Micro-checking usually occurs only in the topcoat film
   b. Refinish as necessary using correct recommended procedures

g. Crazing

Show Transparency: Fig. 20

1. Causes
   a. Shop temperature too cold
   b. Condition of old surface

   Note: The surface tension of the original finish material is under stress and literally shatters or breaks up under the softening action of the solvents in the material being applied
   c. Improper thinners or reducers
2. Prevention
   a. Allow shop, metal surface, and materials to come to equal temperatures before spraying
   b. Sand out any traces of crazing in the old surface before refinishing
   c. Use correct amount of quality thinner or reducer
3. Cure (2 methods)
   a. Method number one
      1. Over reduce paint approximately 25%
      2. Apply two full wet coats to the affected area

   Note: Use a slow flashing thinner and apply coats as wet as shop conditions will allow in order to melt the crazing and flow the pattern together
   b. Method number two
      1. Use unthinned paint
      2. Thin according to label directions

   Note: Use a fast flashing thinner which will allow a bridging of subsequent topcoats over the crazing area
      3. Apply medium thin coats until surface is smooth
      4. Allow sufficient drying time between coats

h. Featheredge cracking

1. Causes
   a. Improper or insufficient preparation of surface before applying undercoats
   b. Failure to stir undercoat material each time before use
   c. "Piling on" of heavy wet coats of undercoat material
   d. Insufficient drying time between undercoats

e. Incorrect mixing
f. Using wrong thinner

2. Prevention
   a. Prepare surface properly
      1. Clean thoroughly with solvent
      2. Sand featheredged spot well back into old finish
      3. Treat bare metal with a metal conditioner
   b. Thin undercoat material according to label directions
   c. Use a slow flashing thinner
   d. Stir material thoroughly before each use
   e. Apply undercoats in medium coats
   f. Allow sufficient drying time after each coat, particularly the first coat
   g. Allow undercoat to completely dry before sanding

3. Cure
   a. Allow affected area to completely dry
   b. Sand finish from affected area and refinish correctly

   Note: As a rule, it is best to sand the affected area down to bare metal, removing the undercoat material completely. Refinish same as spot repair procedure in VII-B-1

i. Fish eyes
Show Transparency: Fig. 21

1. Causes
   a. Improper preparation and cleaning of old surface
   b. Surface contamination, from:
      1. Air or feed lines
      2. Shop towels or rags
      3. Natural oils from skin
      4. Atmosphere of shop

2. Prevention
   a. Clean old surface with a solvent cleaner before sanding operations
   b. Use plenty of solvent and clean rags

   Note: Do not allow solvent to dry by itself, but wipe dry quickly with a clean, dry rag

   c. Bleed all air lines and compressor tank daily

d. Avoid touching surface with the bare hands prior to painting
e. Painting should be done in a clean, well ventilated area to reduce chances of contamination from the atmosphere
f. Add recommended amount of fish eye preventer to thinned paint

3. Cure
a. Allow affected area to thoroughly dry
b. Sand lightly with #400 grit (or finer) sand paper
c. Thin paint according to label directions with a slow flashing thinner
d. Add recommended amount of fish eye preventer
e. Spray 2 full wet coats over area
f. Allow ample flash time between coats

Note: In severe cases of fish eye, affected areas should be sanded completely off and refinished

j. Lifting

Show Transparency: Fig. 22

1. Causes
a. Old paint surface not completely cured before refinishing
b. Applying lacquer over enamel paints or enamel undercoats
c. Wrong reduction or thinning
d. Wrong drying procedure

2. Prevention
a. Avoid use of acrylic or lacquer products over air dried enamel
b. Sand old surface thoroughly before refinishing
c. Reduce or thin paint according to label directions

Note: Do not use lacquer thinner in enamel paint to speed up drying

d. Second coats of enamel should be sprayed over first coat immediately after application of first coat
e. Do not apply topcoat over undercoats that have not completely dried or cured

3. Cure

Note: They only recommended method of repairing a lifting problem is to completely

remove the lifted area and refinish
a. Allow affected area to dry completely
b. If affected area is small or lifting is minor, treat same as spot repair
c. If lifting is severe or area is extensive, refinishing complete vehicle is recommended

Note: In either case, all affected material must be removed and area sanded thoroughly before refinishing. Follow correct procedures for refinishing

k. Mottling

Show Transparency: Fig. 23

1. Causes
   a. Temperature / humidity conditions
   b. Improper mixing
   c. Using wrong thinner
   d. Incorrect spraying technique
2. Prevention
   a. Allow shop, metal surface, and materials to equal in temperature before spraying
   b. Thin or reduce according to label directions
   c. Use correct thinner for existing weather or temperature conditions
   d. Avoid spraying extremely heavy coats

   Note: Alternating vertical and horizontal painting strokes helps prevent mottling in most cases
3. Cure (2 methods)
   a. Method number one
      1. Under reduce paint approximately 25%
      2. While flooded paint film is still wet, apply a medium mist coat to the flooded area
      3. Allow area to flash or dull out
      4. Over reduce paint approximately 50% and apply a thin mist coat to area
   b. Method number two
      1. Allow flooded area to dry thoroughly
      2. Thin paint according to label directions, using a faster flashing thinner

3. Refinish area, using correct procedures and spraying techniques

1. Orangepeel

1. Causes
   a. Extreme temperature / humidity
   b. Insufficient material reduction
   c. Incorrect spraying technique
   d. Incorrect air pressure
   e. Using wrong thinner or reducer
   f. Improper drying time
2. Prevention
   a. Use manufacturer's recommendations for reducing
   b. Use proper thinner for existing temperature / humidity conditions
   c. Allow temperature of shop, materials, and metal surface to equalize
   d. Use sufficient air pressure to atomize material properly
   e. Hold gun correct distance from surface (6 to 10 inches)
   f. Apply second coat of refinish material before first coat has flash dried
3. Cure (2 methods)
   a. Method number one
      1. Allow the finish to thoroughly dry
      2. If orangepeel is slight (especially) in acrylics or lacquers) it may be polished out with rubbing compound and polishing cloth or buffer

   Note: If orangepeel is more pronounced, it may be necessary to water sand lightly too before compounding

   b. Method number two
      1. Allow finish to dry thoroughly
      2. Prepare surface for all over topcoat application (VII-A-3(S))
      3. Use #400 grit sandpaper (or finer)
      4. Reduce paint with a slow flashing reducer

   Note: When spraying acrylics or lacquer, up to 10% by volume of a high quality retarder may be added to improve flow out

      5. Refinish vehicle completely using recommended procedures

m. Pinholing

Show Transparency: Fig. 24

1. Causes
   a. Presence of moisture in air source
   b. Improper preparation of surface prior to painting
   c. Improper drying
   d. Insufficient drying time between coats
2. Prevention
   a. Bleed air lines, air pressure regulator, and compressor tank daily
   b. Clean and dry surface thoroughly before spraying
   c. Do not try to speed up drying by "fanning" or blowing air with spray gun between coats
   d. Allow adequate flash time between coats
3. Cure
   a. Allow affected area to dry completely
   b. Sand area down to a smooth finish and refinish

   Note: Use a rubber sanding block and #400 grit sandpaper
   c. Refinish, using spot repair techniques
   d. If pinholing is severe, complete vehicle refinishing is recommended

n. Sags or runs

1. Causes
   a. Improper material reduction
   b. Incorrect air pressure
   c. Applying excessive material
   d. Poor or incorrect spraying techniques
2. Prevention
   a. Use manufacturer's recommendations for type and amount of thinner or reducer
   b. Use adequate air pressure for proper atomization of material being sprayed
   c. Do not "pile on" topcoats (rely on thin to medium coats)
   d. Allow sufficient flash time between coats
   e. Use correct spraying techniques
      1. Pattern adjusted to medium oval
      2. Correct gun distance (6 to 10 in.)
      3. Good triggering action at beginning

and end of strokes

f. Avoid excessive overlap of painting strokes

3. Cures (2 methods)

a. If paint film is still wet

1. Lightly brush out run or sag with a fine camel hair brush
2. Spray one light coat immediately over the affected area

Note: If runs or sags are severe or extensive, wash off paint film immediately with solvent and clean, lint free rags. Refinish completely, using recommended procedures

b. If paint film has flashed or begun to dry

1. Allow paint to become completely dry and hard
2. Sand out run or sag with #400 grit sandpaper, rubber sanding block, and small amount of water
3. Polish out or refinish as necessary

o. Sandscratch swelling

Show Transparency: Fig. 25

1. Causes

a. Improper preparation of surface prior to spraying
b. Using too coarse grit sandpaper
c. Insufficient drying of undercoat before sanding
d. Use of poor quality thinner or reducer

2. Prevention

a. Clean surface thoroughly before sanding
b. Use fine grit sandpaper (#320 or finer) sanding well back into the old finish
c. Allow adequate drying time between coats of undercoat
d. Allow final coat of undercoat to dry completely before sanding
e. Reduce or thin paint with amount and type thinner recommended by paint manufacturer
f. Apply pain in medium wet coats, allowing adequate flash time between coats

3. Cures

a. Allow paint to dry thoroughly

b. Polish out scratches with rubbing compound and clean polishing cloth or power buffer
c. If scratches are extensive or severe, sand surface smooth and refinish as necessary

p. Shrinking of putty

1. Causes
   a. Putty applied too thick
   b. Improper drying time
   c. Extreme temperature / humidity
2. Prevention
   a. Allow temperature of shop, metal surface, and material to equalize

   Note: In extreme cold or damp weather a drying lamp should be used to warm up surface before applying putty
   b. Apply putty in thin coats
   c. Allow putty to dry completely hard before sanding
3. Cure
   a. Remove putty in affected area and reapply in a series of thin coats
   b. If shrinking is slight, block sand affected area with sanding block and #320 grit sandpaper

   Note: In most cases it is a good practice to apply a coat of sealer over the sanded putty before applying the topcoat

q. Solvent popping

Show Transparency: Fig. 26

1. Causes
   a. Improper surface preparation
   b. Use of wrong thinner or reducer
   c. Excessive film thickness
   d. Insufficient drying time between coats
2. Prevention
   a. Clean and dry surface thoroughly before spraying
   b. Use a slow flashing thinner when mixing undercoats
   c. Thin according to manufacturer's recommendations
   d. Do not "pile on" heavy coats of undercoats
   e. Allow each coat to flash before applying succeeding coats

3. Cure
   a. Allow each coat to dry completely hard
   b. Use sanding block and #320 grit sandpaper
   c. Sand affected area until surface is smooth
   d. Refinish as necessary

   Note: If damage is extensive or severe, surface must be sanded down to undercoat or metal, depending on depth of blisters

r. Water spotting

1. Causes
   a. Excessive topcoat film
   b. Allowing moisture (water, rain, or dew) to get on finish before it is completely dry
   c. Washing car in direct sunlight
   d. Mineral content of wash water
   e. Excessive use of wax
2. Prevention
   a. Apply topcoat in normal film thickness
   b. If possible, do not expose new finish to water until it has completely dried
   c. If water does get on surface, dry off immediately with chamois or soft clean cloths
   d. Do not wash vehicle until new finish has completely cured (approximately 30 days)
   e. Place vehicle in shade and allow to cool off before washing
   f. Dry thoroughly after washing
   g. Avoid over use of waxes
3. Cure
   a. Wash affected area with cool, clean water
   b. Rub spots lightly with damp rag
   c. Dry surface with chamois or clean soft cloths
   d. Polish affected area lightly with a very fine polishing compound
   e. Use very light hand pressure
   f. If using a power buffer, use a clean lamb's wool polishing bonnet on buffer

Note: If polishing does not give satisfactory results, the affected area must be sanded and refinished

s. Wrinkling

Show Transparency: Fig. 27

1. Causes
   a. Excessive film thickness
   b. Improper reduction
   c. Improper drying
   d. Exposure to hot sunshine before topcoat is thoroughly dry
   e. Abnormally hot and humid weather
   f. Force drying air dry enamels without using a baking converter
2. Prevention
   a. Avoid excessive film buildup
   b. Use recommended reducer and reduce according to manufacturer's label directions
   c. Do not try to speed up drying time of air dry enamels by blowing with air
   d. Do not allow excessive drying of first coat of enamel before applying second coat
   e. Allow finish to dry thoroughly before exposing to hot sunshine
   f. If possible, avoid spraying enamel in abnormally hot, humid weather
   g. Use manufacturer's recommended amount of baking converter or hardening agent when force drying enamels
   h. When force drying enamel, never allow temperature to exceed 160°
3. Cure
   a. Allow wrinkled area to dry completely hard
   b. Sand affected area until surface is completely smooth
   c. Apply one light coat of sealer
   d. Refinish as necessary

   Note: This is the only recommended course of action when wrinkling occurs

5. Effects of painting problems
   1. Loss of revenue
   2. Needless waste of time and materials
   3. Breakdown of work efficiency
   4. Can lead to poor customer relations

III. APPLICATION (DRILL, ILLUSTRATIONS, ANALOGIES, ORAL QUESTIONS OR ASSIGNMENTS, MAKING INVESTIGATIONS OR EXPERIMENTS, NOTE TAKING, MAKING SKETCHES, PARTICIPATING IN DISCUSSION.)

1. Have one student describe a paint problem and another student tell the recommended procedures for repairing that problem
2. Have each student simulate a different painting problem on a metal coupon as a class project
3. As each coupon is displayed, have class name the various ways of preventing that particular painting problem

IV. VERIFICATION AND/OR EVALUATION (FINAL CHECK ON STUDENTS' COMPREHENSION OF MATERIALS PRESENTED.)

1. What is the most common cause of many painting problems?
2. Why is surface preparation so important?
3. What is meant by the term "flash"?
4. "Fanning" describes what action?
5. What is the difference between thinner and reducer?
6. Retarder is used for what purpose?
7. "Orangepeel" describes what paint condition?
8. What is the result when lacquer is sprayed over enamel?
9. What is the most common cause of runs or sags?
10. How much retarder is added to lacquer paint?
11. What is the difference between line checking and micro checking?
12. What product is used to overcome fish eyes?
13. How can poor technique cause painting problems?
14. Why is it important to use top quality materials?
15. What effect does temperature and humidity have on lacquer paint?

V. SUMMARY (GIVE A BRIEF ACCOUNT OF EACH TOPIC REEMPHASIZING THE IMPORTANT POINTS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENT.)

1. Thorough surface preparation and correct spraying techniques are important in preventing painting problems

2. Using recommended amounts of top quality products is a must for a trouble free refinishing job

3. It is easier to prevent a painting problem than to repair it after it has occurred

SUGGESTED READING FOR THE STUDENTS:

Automotive Refinishing Principles and Techniques, pp. 80-81
Refinisher's Guide, pp. 8-10, 23, 37

The Next Lesson Is: VII-C-1(I) "Refinishing With Enamels"

SUBJECT: Painting Problems

INTRODUCTORY
INFORMATION:

A majority of the problems encountered in refinishing arise, in most cases, from one of three reasons; improper material selection, poor spraying techniques, or poor preparation. Many of the cheap, second-rate painting products available and short-cut techniques or procedures are often used by the less discriminating refinisher. For the true professional, however, they do not exist.

GENERAL INFORMATION:

Generally speaking, very few paint problems are caused by quality products. The reason for this is that most paint and painting products manufacturers carefully and continuously check each step in the manufacturing process to insure that their products measure up to high standards of quality and performance. Each product is formulated and designed for a specific purpose and must be used and handled in such a way as to fit properly into the complete refinishing system. This quality control is conducted by many highly trained personnel, each usually skilled in one step of the manufacturing process.

Automotive refinishers, on the other hand, are usually persons doing many different things in the repair shop. Each job is a little different. It can happen that they fail to perform one particular step that is required, or they may fail to do the step the correct way. They may use a product not suited for the job at hand, or mix two products that are not compatible. Even the discriminating professional painter occasionally finds that a paint job does not turn out right. By avoiding the most common causes, however, one can keep painting problems to a minimum. Remember that most painting problems can be traced to one of the three causes mentioned earlier: using cheap or improper materials, poor spraying techniques, or not preparing the surface properly.

There are ten basic rules which, if carefully followed, will become habit and will eliminate most painting problems.

1. Clean The Surface - Never cut corners in surface preparation. Washing with soap and water, removing surface contaminants with a solvent cleaner, and etching bare metal spots with a phosphate cleaner are all musts.

2. Take Your Time - Never rush the job! At each stage or step in the repair process, take the time required to do it correctly. Ten minutes saved on a "shortcut" may require hours of rework. Every rework carries a double loss for the painter

and the shop: there is no revenue for the rework and you are using time that could be spent profitably on the next job in line.

3. Sand Correctly - Use the recommended grit for the type material being used. Sand the surface thoroughly, paying particular attention to the areas next to moldings, handles, creases, body joints, and windows. Fold or cut the sandpaper as necessary to reach these tight places. Use a rubber sanding block on flat surfaces and water sand whenever possible.

4. Use Top Quality Products - One cannot economize on painting products! You may be able to save a few cents on the gallon, but you will usually pay out dollars in time and effort spent in making up for the inherent shortcomings of cheap products.

5. Select Proper Materials - Select the product that is best suited for the existing conditions. Read and carefully follow label directions for each product. Take care to use products that are compatible and buy the very best grade that is available.

6. Stir And Strain - Regardless of who manufactures the paint, or what type of paint it is, always stir thoroughly. Stir again after adding thinners, reducers, or special additives. Never pour paint into the paint gun cup without straining, and use a clean strainer each time.

7. Use Correct Techniques - Use recommended gun adjustments and spraying procedures. Allow proper flash and drying time between coats. Do not attempt to dry paint by fanning (blowing air) with the paint gun. Never apply any more material than is necessary.

8. Use Low Air Pressure - Why be wasteful or cause yourself extra work? Excessive air pressure can cause a variety of problems such as overspray, poor adhesion, porosity, poor gloss, and runs, or sags. It also wastes material. When properly reduced or thinned, paint can be perfectly atomized at low air pressures. Forty to sixty pounds at the gun is a good range for most purposes.

9. Care For Your Equipment - Buy the very best painting equipment you can afford. There is no substitute for good equipment kept clean and in good repair. Clean the paint gun and the paint cup thoroughly immediately after each use. Drain the air compressor tank, all air lines and hoses, and the air pressure regulator daily to remove trapped moisture. Use a systematically planned program of inspection and maintenance on all painting equipment to insure years of trouble free operation.

10. Keep Informed - (Probably the most important single rule) Ask yourself these questions: Am I working with modern methods? Is there a better or faster way without sacrificing quality? What about my equipment, tools, and materials - Do they help or slow me down? Can I in some way improve the final quality? Through continuous research and developments the refinishing industry is constantly changing. Keep yourself informed of new developments in painting products, tools and equipment, and new spraying techniques.

By practicing these basic rules until they become habit you can keep your painting problems to a minimum. This holds true in every stage of the refinishing procedure from the very beginning of the job until the final coat is dry and the vehicle is ready for delivery to the customer.

INFORMATION SHEET
ON
PAINTING PROBLEMS

VII-B-4b(IS)

GLOSSARY OF TERMS AND DEFINITIONS:

1. Adhesion Loss and Peeling: (Also known as scaling or flaking) poor bond between paint film and surface.
2. Blistering: (Also known as pitting, pinholing, or pock marks) small bubbles or pimples in the topcoat film.
3. Blushing: A milky and sometimes dull appearance formed in acrylic and lacquer films during or shortly after spraying.
4. Cracking: A series of deep cracks resembling mud cracks in a dry pond. Not necessarily connected and often in no definite pattern.
5. Line Checking: Similar to cracking, except that the lines or cracks are more parallel. They may be very short or up to 18 inches long.
6. Micro Checking: A great number of very small cracks that do not connect or touch each other. Makes the entire surface appear very dull.
7. Crazing: (Also known as alligatoring, cobwebbing, or crow's feet) very fine splits or hairline cracks completely checkering an area in an irregular manner.
8. Featheredge Cracking: Appears as stretch marks or splitting along the feather-edge of a repaired area.
9. Fish Eyes: Small, crater like openings in the finish after it has been applied. Usually shows up immediately after spraying.
10. Lifting Usually appears as surface distortion or shriveling while the topcoat is being applied or while drying.
11. Mottling: Usually occurs when applying metallics. The metal flakes float to form a spotty appearance.
12. Orange Peel: Appears as an uneven, pebbly formation on the surface similar to that of an orange.
13. Pinholing: (Also known as pitting or pock marking) tiny holes in the surface which may appear in groups. May look like blisters which have burst.
14. Runs or Sags: (Also known as curtains) paint appears to have slipped or to droop due to excessive build up. May be wrinkled along edge.
15. Sandscratch Swelling: Has the appearance of magnified of exaggerated scratches in the surface film.
16. Shrinking of Putty: Appears as a cracking or a pulling away of the topcoat and undercoat layers from a repaired area.
17. Solvent Popping: Appears as small craters or depressions in the paint surface.
18. Water Spotting: Appears as a small stain or dull spot in the topcoat.
19. Wrinkling: Appears as surface distortions or ripples much like a washboard surface. Usually occurs during the drying stage.

INSTRUCTOR'S PLAN VII-C-1(I)
INFORMATIONAL LESSON

SUBJECT: Refinishing With Enamels

AIM: The student will be able to recognize the advantages and disadvantages of enamel paints as opposed to lacquers, and identify the procedures involved in their application.

TEACHING AIDS: Display of products

TOOLS AND EQUIPMENT:

REFERENCES:
1. Automotive Refinishing, pp. 81-82
2. Refinisher's Guide, pp. 35-38

PREREQUISITE EXPERIENCE OF THE LEARNER: The student must have successfully completed the previous lessons and must have studied information sheet VII-C-1(IS) "Enamel Paint"

I. PREPARATION (OF THE LEARNER - MOTIVATION)

As a rule, enamel paints are easier to apply than lacquers and require less maintenance and upkeep to retain their beauty. The spraying procedures involved are basically the same.

II. PRESENTATION (OF THE INFORMATION)

INSTRUCTIONAL TOPICS TEACHING POINTS	THINGS FOR STUDENTS TO DO THINGS FOR INSTRUCTOR TO DO OR SAY
1. Types of Enamels	1. Alkyd enamel a. Oldest of all the enamel finishes b. Easy to apply c. Requires no compounding d. Makes a durable, long lasting finish 2. Acrylic enamel a. Extremely fast drying (dust free in 20 minutes) b. May be used for spot paint repairs c. Can be compounded if desired d. Makes a hard, durable finish e. May be purchased as undercoats such as primers and sealers f. Will not blister the edges of a repaired spot 3. Polyurethane enamel a. Newest of the enamel products b. Contains a clear plastic liquid used as a binder

c. Must be mixed with a catalyst or activator before using
d. Extremely tough and flexible
e. May be used in a variety of custom applications

2. Preparation Procedures
1. Basically the same as lacquers
2. Each different type of enamel takes a different reducer
3. Read package directions for paint/reducer ratio
4. Mixed urethane enamels cannot be returned to original container
5. Vehicle preparation is exactly the same as when using lacquers

3. Spraying Techniques
1. Basically the same, regardless of which of the 3 types of enamel is being sprayed
a. Adjustments of spray gun are identical
b. Air pressure is the same, 50 to 65 lbs at the gun
c. Distance of gun to surface should be 8 to 10 inches, or one handspan
d. Gun travel speed should be approximately one foot per second
2. Differs slightly from spraying lacquers
a. Higher air pressure is used
b. Usually no more than 3 coats are required for coverage

4. Advantages Over Lacquer
1. Requires less materials, therefore is less costly to use
2. Requires no compounding or waxing
3. More durable
4. Requires less care to retain beauty
5. Is more flexible, resists chipping and cracking

5. Disadvantages
1. Slower drying time
2. Painting problems cannot be corrected as readily
3. Is difficult to use to spot paint

III. APPLICATION (DRILL, ILLUSTRATIONS, ANALOGIES, ORAL QUESTIONS OR ASSIGNMENTS, MAKING INVESTIGATIONS OR EXPERIMENTS, NOTE TAKING, MAKING SKETCHES, PARTICIPATING IN DISCUSSION)

1. Review stage II and emphasize key points.

2. Discuss the merits of each type enamel.
3. Use teacher prepared panels painted with the different enamels to illustrate appearance of each.
4. Discuss important of safety practices in painting.
5. Ask questions of several students about spraying techniques used with enamels and discuss answer with class.

IV. VERIFICATION AND/OR EVALUATION (FINAL CHECK ON STUDENTS' COMPREHENSION OF MATERIALS PRESENTED.)

SIMPLE RECALL

1. There are three basic types of enamels.
2. These are alkyd, acrylic, and polyurethane.
3. Enamel is usually more durable than lacquer.
4. Spraying techniques are basically the same for all types of enamels.
5. Enamels dry slower than lacquer.
6. Most overall refinishing is done with enamels.
7. Enamels will usually cover satisfactorily with 3 coats.
8. Enamel paint requires no compounding.
9. Acrylic enamel can be used for spot painting.
10. Enamels are sprayed with slightly higher air pressure than lacquers.

V. SUMMARY (GIVE A BRIEF ACCOUNT OF EACH TOPIC REEMPHASIZING THE IMPORTANT POINTS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENT.)

1. Enamel top coats are easier to apply than lacquers.
2. There are 3 types of enamels.
3. Polyurethane is the latest development in automotive paints.
4. Enamel products dry much slower than lacquer.
5. An enamel topcoat requires no compounding.
6. Most overall refinishing is done with enamels.
7. Enamel should be mixed according to package label directions.
8. The same basic spraying techniques are used when spraying any of the 3 enamels.

9. Enamels produce a more durable topcoat than lacquer.

10. Surface preparation should be the same, regardless of the type material being used for topcoat.

SUGGESTED READING FOR THE STUDENT:

Autobody Repairing And Repainting, pp. 159-202
Refinisher's Guide, pp. 8-10, 23, 37

The Next Lesson IS: VII-C-1(S), "Make Panel Repair Topcoat Application (Enamel)"

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INFORMATION SHEET
ON
REFINISHING

VII-C-1(IS)

SUBJECT: Enamel Paint

INTRODUCTORY
INFORMATION:

The development of enamel paint has been of great benefit to the automotive industry. Most automotive refinishers prefer enamel over lacquer, particularly for all over topcoat applications.

GENERAL INFORMATION:

Enamel paint was first developed in the mid 1930's. Since that time most new cars and almost all new trucks have been painted at the factory with some type of enamel paint. This includes most foreign vehicles also.

When properly applied, enamels flow out to a high-gloss, durable finish at a nominal cost. These paints may be force dried in an infrared bake oven, or left to air dry in the paint booth. Either method produces a finish that is strong and flexible and requires very little upkeep to retain its beauty.

In automotive refinishing, the main advantage of enamel is the fact that it dries to a high gloss without compounding and polishing. Enamels cost less initially and less of the material is used, since usually only three coats are required for coverage. This results in a saving of both time and money. Furthermore, enamel is a better filling product and covers small surface imperfections fairly well.

For body shop refinishing, the main disadvantage of enamel paints is that they are slow to dry. It is therefore necessary to have a very clean, well ventilated paint booth or suitable paint room to prevent dust or dirt from settling in the wet paint while it is drying. The use of enamel is usually limited to complete panel or overall refinishing. Since the enamel solvent will not penetrate the old topcoat material and cannot be compounded, it is not suitable for spot painting.

There are three basic types of enamel paint in use today: alkyd enamel, acrylic enamel, and polyurethane enamel. Since all three types are being used worldwide, it is very important for the painter to know the characteristics and limitations of each.

Alkyd Enamel - First developed in the 1930's and is still very popular with painters today. This enamel is widely used for overall refinishing. Some of its advantages are speed of application, the ability to cover well, and the fact that it can be easily applied over other types of finishes. Very small scratches or chips are more easily covered with alkyd enamel than with either lacquer or the other types of enamels.

The speed with which the job may be done and the fact that it requires no compounding or polishing make alkyd enamel refinishing popular for low priced work. The main disadvantage of alkyd enamel is its extremely slow drying time. This can cause problems of dirt and dust getting into the paint before it is dry. If this happens, or any other type of painting problem occurs, such as a run or sag, either the entire affected area must be washed off completely with solvent and resprayed immediately, or the painter must wait several hours for the paint to dry before correcting the problem. This slow drying time also means that each paint job will require more time in the paint shop, thus affecting the volume of work the painter may turn out.

Acrylic Enamel - This is by far the most popular type of enamel in use today. Almost all new trucks, many new foreign cars, and the cars of at least three of the major American manufacturers are finished at the factory with acrylic enamel. Many body shop refinishers use it also because it has all the advantages of alkyd enamel, but dries almost as fast as lacquer. This faster drying time is made possible by a special ingredient mixed into the paint by the manufacturer. It is a transparent, thermoplastic resin known as "acrylic" and is mixed into the binder part of the acrylic paint mixture. Because of this a special reducer must be used to thin acrylic enamel to spraying viscosity. There are also other special additives available, and only these products recommended for use with acrylic enamel only should be mixed with this paint.

The main advantage of acrylic enamel is, of course, its fast drying time. When properly mixed with the correct amount and type of reducer, most acrylic enamels will dry dust free in from 15 to 20 minutes. Properly applied, it will usually dry to a smooth glossy shine within 30 to 45 minutes. This eliminates the long hours of drying time normally associated with enamel paints, which means a higher volume of work for the painter, hence more profits. Unlike alkyd enamel, most acrylic enamels may be compounded if necessary. This can be a real advantage when correcting paint defects or problems, since it is faster than sanding and repainting. For best results, however, acrylic enamel should never be compounded until it has cured or hardened for 30 days after application.

The main disadvantage of acrylic enamel is that it cannot be recoated for a week after it has been sprayed. If the sprayed finish has dried for 6 hours or more and for some reason must be recoated, there must be a waiting period of at least a week before recoating is attempted.

Polyurethane Enamel - This is the latest development in enamel paints and is still relatively new to the refinishing trade. This enamel has the same basic formula (pigment, binder, solvent) as the other enamels, with one exception. The manufacturers add a clear polymer plastic resin to the binder. At the time of use, the painter adds a clear epoxy activator to the amount of enamel needed for the job at hand. This epoxy contains certain additives to chemically activate the paint and cause the film of paint (or topcoat) to dry to an extremely tough and durable finish.

The major advantage of polyurethane enamel is its extremely short drying time. Some of this enamel is designed to dry so quickly that it may be sprayed "on location" and dries dust free in 15 to 20 minutes. This is very beneficial in commercial applications, such as the trucking industry, where vehicle down time must be kept to a minimum. This enamel is easy to apply and produces a finish that is chip resistant, holds its gloss extremely well, and resists road tars and most chemicals. In a situation where a vehicle is to be painted two or more colors, this enamel will dry tape free in two to four hours, which means that the vehicle being painted can be delivered sooner than when working with other enamels.

The main disadvantage of polyurethane enamel is that it is mixed differently than other enamels and this may be confusing to the painter at first. When purchased, this paint comes in two parts; one can containing the enamel itself and another can containing the clear epoxy activator. These two must then be mixed according to label directions, usually about three parts enamel to one part activator. When properly mixed this paint needs no further thinning and may be sprayed full strength.

One note of caution the painter must keep in mind: Once mixed this paint has a maximum useful life of only 72 hours. The painter must learn to mix only that amount necessary for immediate use. The spray gun and all mixing equipment must also be cleaned immediately after use. If left in the gun for too long a time this material cannot be removed. If you forget, an expensive paint gun will be ruined.

Basic spraying techniques and procedures will remain the same, regardless of the type enamel being sprayed. The same gun adjustments, distance, and travel speed, along with painting sequence and pattern overlap may be used with equally pleasing results.

As in any refinishing operation, surface preparation of the vehicle is of paramount importance. Each step in the preparation procedure must be thorough, and no step should be overlooked or eliminated.

When properly executed, an all over enamel paint job (regardless of the type enamel used) will be more durable and have most of the beauty of a lacquer job, and at a fraction of the cost in both money and labor energy expended.

INSTRUCTOR'S PLAN VII-C-1(S)
MANIPULATIVE LESSON

TASK:	Make Panel Repair Topcoat Application (Enamel)
AIM:	The student will be able to apply enamel to a panel repair
TOOLS AND EQUIPMENT:	Compressed air, air hose, suction type gun, mixing paddle, strainers, blower nozzle or dusting gun, respirator mask
MATERIALS:	Enamel, enamel reducer, clean shop towels, tack rag
TEACHING AIDS:	
REFERENCES:	Auto Body Repairing and Repainting, pp. 159-202 Collision Repair Guide, pp. 236-250 The Principles of Auto Body Repairing and Repainting, pp. 371-453 Automotive Collision Work, pp. 337-374 Automotive Refinishing Principles and Techniques, pp. 80-81 Refinisher's Guide, pp. 8-10, 23, 37 A Guide to Better Automotive Refinishing, pp. 24-25, 28-29
PREREQUISITE EXPERIENCE OF THE LEARNER:	The learner must have prepared the surface following the procedures in lesson VII-A-2(S), "Prepare Surface for Complete Panel Refinishing"
CHECKING STANDARDS:	1. Selection of materials 2. Proper preparation and application of topcoat 3. Appearance of topcoat 4. Proper use of tools and equipment

I. PREPARATION (OF THE LEARNER - MOTIVATION)

There are occasions when enamel is preferred in panel repair. The speed of application, the ability to cover well, and the fact they can be easily applied over other types of finishes are some of the advantages.

II. PRESENTATION (OF THE SKILLS)

STEPS	KEY POINTS (THINGS TO REMEMBER TO DO OR SAY)
1. Preparation	1. Perform all tasks outlined in lesson VII-A-2(S), "Prepare Surface for Complete Topcoat Application (Alkyd Enamel)" 2. Remove tape and paper from around repaired panel 3. Wipe water from around mouldings and panel openings

4. Thoroughly clean spray booth
5. Place vehicle in spray booth

2. Dust Surface

1. Dust surface and cracks with dusting gun
2. Remove all water, sand residue, and dirt
3. Make final inspection of surface for small sandscratches that must be removed

3. Final Masking

1. Retape and paper surrounding panel
   a. Place paper and tape as close to the repair panel as possible without touching it
   b. Place two papers 18" wide around the panel

   Caution: It is necessary to completely cover the remaining area that is not to be painted. If not covered alkyd enamel overspray will cause serious damage to exposed surface

2. Cover the remaining area with paint drop cloths or masking paper
3. Tape down edges of paper firmly to keep it from blowing into the fresh paint or exposing protected surfaces to overspray

4. Tack Wipe

1. Wipe complete panel with tack rag
2. Remove all dust and lint
3. Do not touch panel with hands

5. Mix Paint

1. Stir paint thoroughly
2. Place strainers in clean paint cup
3. Pour needed amount of paint into strainer
4. Add the proper reducing solvent
   Note: For best painting results, select a reducer suitable for existing shop conditions
   Note: Read the mixing instructions for proper amount of reducing solvent
5. Stir the paint and solvent into cup

6. Make a Test Panel

Caution: A respirator mask should be worn when spray painting

1. Place sheet of paper on wall to test pattern
2. Set pattern open for panel painting
3. Spray metal test panel for color matching
   a. Completely cover exposed strip of panel

b. Let flash and compare with color on vehicle
c. If color is correct, proceed

7. Apply Topcoat

1. Adjust pressure at gun to the recommended setting of the enamel paint manufacturers
2. Hold the gun parallel and 8 to 10 inches from panel
3. Move the gun with steady, deliberate pass, about one foot per second
   Caution: Do not arc the gun
4. Hold the air hose with the other hand
5. Release the trigger at the end of each pass
   Note: On panel refinishing, try to make a single pass the complete length of the panel
6. Start the pass outside the panel area, pull the trigger just before the nozzle passes directly over the edge of the panel
7. Release the trigger as the gun reaches the other edge of the panel
8. Pull the trigger again as you begin the pass in the opposite direction
9. The second pass should overlap one-half of the width of the first spray pattern
10. Cover the panel completely
11. Let the panel set until the overspray on the taped edge has become tacky
12. Apply 2 to 3 topcoats, depending on the color reducer and brand of paint used

8. Apply Mist Coat

Note: Mist coat is sometimes needed to blend overspray or metallic streaking and to produce maximum gloss and smoothness

1. Mix approximately three parts color to five parts of reducer in cup
2. Partly close fluid feed and dust a light coat over the entire area
3. If necessary repeat the operation
   Note: Metallic streaks should be mist coated while paint is still wet

9. Clean Spray Gun and Store Materials

1. Clean spray gun (refer to task sheet VII-A-1(TSm))
2. Replace lids and caps on material containers

3. Replace spray gun and materials in storage area

10. Clean Up Vehicle

Note: Let the painted panel dry overnight before removing the masking paper and cleaning the vehicle

1. Remove all masking tape and paper
2. Clean all mouldings, bumpers, and grille
   Note: Any mouldings that have been removed should be installed at this time
3. Clean glass area
4. Clean and vacuum inside of vehicle
5. Scrub tires and wheels with soap and water, if necessary

11. Clean Work Station

1. Return all tools and equipment to storage area
2. Sweep and pick up all trash and debris
3. Use mop or squeegee to clean up all water

III. APPLICATION (PRACTICE BY LEARNER UNDER CLOSE SUPERVISION)

1. Students to practice applying enamel in complete panel application
2. Observe and reteach, if the need arises, the complete panel topcoat application process
3. Check students for key points
4. Have students repeat key points as they perform tasks

IV. VERIFICATION AND/OR EVALUATION (CHECK ON STUDENT'S ABILITY)

Allow student to do complete job, supervising when necessary (performance test)

V. SUMMARY (TELL THE STEPS ON PROCEDURE AS TO WHAT, HOW, AND WHY. REVIEW CHECKING STANDARDS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENTS.)

1. Repeat steps and key points
2. Emphasize safety

SUGGESTED READING FOR THE STUDENTS:

Auto Body Repairing and Repainting, pp. 159-202

Collision Repair Guide, pp. 236-250
The Principles of Auto Body Repairing and Repainting, pp. 371-453
Automotive Collision Work, pp. 337-374
Automotive Refinishing Principles and Techniques, pp. 80-81
Refinisher's Guide, pp. 8-10, 23, 37
A Guide to Better Automotive Refinishing, pp. 24-25, 28-29

The Next Lesson Is: VII-C-2(S), "Make Overall Topcoat Application (Enamel)"

JOB:	Make Panel Repair Topcoat Application (Enamel)
MATERIALS:	Enamel paint, enamel reducer, strainers, paddles tac rag
TOOLS AND EQUIPMENT:	Suction paint gun, air supply, blower nozzle
GENERAL INSTRUCTIONS:	Before beginning this job the student must have prepared the vehicle according to Lesson VII-A-2(J) "Prepare Surface For Complete Panel Refinishing", and must have passed the test stage of Lesson VII-C-1(I) "Refinishing With Enamels"

PROCEDURES AND/OR TASKS:	VII-B-2a(TS)	Make Final Preparations
	VII-B-1b(TS)	Mix Paint
	VII-B-1c(TS)	Make Test Panel
	VII-B-2b(TS)	Apply Topcoats
	VII-A-1g(TS)	Clean Up

INSTRUCTOR'S PLAN VII-C-2(S)
MANIPULATIVE LESSON

TASK: Make Overall Topcoat Application (Enamel)

AIM: The student will be able to make complete topcoat application on a vehicle.

TOOLS AND EQUIPMENT: Compressed air, air hose, suction type paint gun, paint stirring paddle, blower nozzle or dusting gun, respirator mask

MATERIALS: Tack rag, paint strainer, enamel paint, enamel reducer, clean shop towels, masking paper, and tape

TEACHING AIDS:

REFERENCES: Auto Body Repairing and Repainting, pp. 159-202
Collision Repair Guide, pp. 236-250
The Principles of Auto Body Repairing and Repainting, pp. 371-453
Automotive Collision Work, pp. 337-374
Automotive Refinishing Principles and Techniques, pp. 80-81
Refinisher's Guide, pp 8-10, 23, 37
A Guide To Better Automotive Refinishing, pp. 24-25, 28-29

PREREQUISITE EXPERIENCE OF THE LEARNER: The learner must have prepared the surface for refinishing following the procedures in lesson VII-A-3(S) "Prepare Surface for Overall Refinish of Topcoat"

CHECKING STANDARDS:
1. Selection of materials
2. Proper preparation and application of topcoat
3. Appearance of topcoat
4. Proper use of tools and equipment
5. Observance of safety rules

I. PREPARATION (OF THE STUDENT -MOTIVATION)

The vehicle's topcoat is important for good customer satisfaction. Customers judge the entire repair job on the appearance of the topcoat. Enamels have been widely used since the early 1930's for overall refinishing repair work. The speed with which the job may be done and the fact that it does not need to be compounded make enamels popular at a low price compared to other finishes.

II. PRESENTATION (OF THE SKILLS)

STEPS	KEY POINTS (THINGS TO REMEMBER TO DO OR SAY)
1. Preparation	1. Perform all tasks outlined in lesson VII-

A-3(S) "Prepare Surface for Overall Refinishing."

2. Place vehicle in ventilated painting area or booth
3. Assemble all needed supplies and materials
4. Turn on fan
5. Wet down paint booth floor with water hose
6. Remove masking tape and paper as necessary for cleaning

   Note: Water and sanding residue has probably accumulated under mouldings or masked areas and must be removed before refinishing operation begins

2. Clean metal surface
   1. Dust surface and panel joints with dusting gun or blower nozzle
   2. Remove all traces of water from underneath mouldings and around panel joints
   3. Wipe down entire surface with cleaning solvent and clean shop towel
   4. Tack wipe entire surface with tack rag

3. Final masking
   1. Remask all glass and chrome if necessary
   2. Tape all joints in masking paper to avoid overspray leakage
   3. Cover wheels

4. Tack wipe
   1. Wipe down complete vehicle with tack rag
   2. Remove all dust and lint
   3. Avoid touching surface with hands

      Note: Natural oils from the skin could contaminate the surface, causing problems in the topcoat

5. Mix paint
   1. Stir paint thoroughly

      Note: This step is most important. If pigment or metallic particles are not completely mixed, the sprayed material may not be a true, exact color
   2. Add proper amount of paint reducer
      a. Follow paint manufacturer's recommendations as to paint reducer ratio
      b. Use proper reducer for shop conditions and temperatures
   3. Strain into clean paint cup

      Note: Enough paint should be mixed at one

time to allow complete coverage of the vehicle without stopping to remix

4. Attach cup to paint gun

6. Make a test panel

Caution: A respirator mask should be worn when spray painting

1. Tape sheet of masking paper to wall
2. Make several spray strokes on paper to check pattern
   a. Adjust fan control valve for large open pattern
   b. Adjust fluid control valve for full wet coverage

7. Apply topcoat

1. Hold gun at right angle to painting surface
2. Gun distance from surface should be one handspan or approximately 8 to 10 inches
3. Alternate right and left painting strokes
4. Use smooth steady stroke
   a. Too fast stroke produces a dry dull finish with spotty coverage
   b. Too slow stroke may produce sags or runs and wastes material
5. Overlap patterns approximately 50%
6. Trigger gun at beginning and end of each stroke

   Note: This is a very important part of the spraying technique. It maintains full coverage, minimizes overspray, and cuts down on the amount of material wasted. It also reduces the risk of runs or sags due to excessive paint build up at ends of stroke
7. Spray top panel first

   Note: When spraying top, hood, or other wide horizontal surface, start at near side and work toward far side. In this manner the overspray lands on a dry surface and will be dissolved into the paint from succeeding strokes
8. Cover entire vehicle, painting one panel at a time

   Note: Panel sequence is not of great importance, but as a general rule, spray top, right doors, right quarter panel, trunk, left quarter panel, left doors, right

	front fender, hood, grill opening, left front fender 9. Spray 2 or 3 full wet coats over entire surface, depending on the color, reducer, and brand of paint used 10. Allow each coat to flash or grow dull before applying succeeding coats Note: When spraying metallic type paints it may be necessary to alternate direction of spraying coats, (one coat sprayed with horizontal strokes, the next sprayed with vertical strokes) to eliminate metallic streaks
8. Apply mist coat	Note: Mist coat is sometimes needed to blend overspray or metallic streaking and to produce maximum gloss and smoothness 1. Mix approximately three parts color to five parts of reducer in cup 2. Partly close fluid feed and dust a light coat of paint over each panel 3. If necessary repeat the operation when fresh paint permits Note: Metallic streaking should be mist coated while still wet
9. Inspection of topcoat	1. Check for thorough even coating of entire vehicle 2. Inspect for runs, sags, or dry spots Note: If runs or sags develop, wait until color is completely dry and hard. Sand out sags or runs with 400 grit paper and water. Polish out or respray as necessary 3. Apply another mist coat to dry spots
10. Clean spray gun and store materials	1. Clean spray gun (refer to task sheet VII-A-1(TSm)) 2. Replace lids and caps on material containers 3. Take spray gun and materials to storage area
11. Clean up vehicle	Note: Let the paint dry over night before removing the mashing paper and clean up the vehicle 1. Remove all masking tape and paper

		2. Clean all mouldings, bumpers, and grille Note: Any mouldings that have been removed should be installed at this time
		3. Clean glass areas
		4. Clean and vacuum inside of vehicle
		5. Scrub tires and wheels with soap and water if necessary
12.	Clean work station	1. Return all tools and equipment to storage area
		2. Sweep and pick up all trash and debris
		3. Use mop or squeegee to clean up all water

III. APPLICATION (PRACTICE BY LEARNER UNDER CLOSE SUPERVISION)

1. Have students practice the complete process of applying a complete overall topcoat using the procedures outlined
2. Check students for key points of each step
3. Observe and reteach, if need arises, the complete overall topcoat application process

IV. VERIFICATION AND/OR EVALUATION (CHECK ON STUDENT'S ABILITY)

Put students on their own to perform tasks, supervising when necessary (performance test)

V. SUMMARY (TELL THE STEPS ON PROCEDURE AS TO WHAT, HOW, AND WHY. REVIEW CHECKING STANDARDS. THIS SUMMARY MAY BE GIVEN AT ANY PLACE IN THE LESSON THE TEACHER FEELS WILL BE PROFITABLE TO THE STUDENTS.)

1. Repeat steps and key points
2. Emphasize safety

SUGGESTED READING FOR THE STUDENTS

Automotive Refinishing Principles and Techniques, pp. 81-82
Refinisher's Guide, pp. 35-38

The Next Lesson Is: VIII-A-1(I) "Wheels And Tires"

JOB:	Make Overall Topcoat Application (Enamel)	
MATERIALS:	Enamel paint, enamel reducer, strainers, paddles, tac rag	
TOOLS AND EQUIPMENT:	Suction paint gun, air supply, blower nozzle	
GENERAL INSTRUCTIONS:	Before beginning this job the student must have prepared the vehicle according to Lesson VII-A-3(J) "Prepare Surface For Overall Refinish Of Topcoat"	
PROCEDURE AND/OR TASKS:	VII-A-2a(TS)	Determine Condition Of Finish
	VII-A-1a(TS)	Initial Preparation
	VII-A-3a(TS)	Clean Vehicle
	VII-A-3b(TS)	Watersand Painted Surface
	VII-A-3c(TS)	Mask Vehicle
	VII-B-1b(TS)	Mix Paint
	VII-B-2b(TS)	Apply Topcoats
	VII-A-1g(TS)	Clean Up